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The Mining Magazine

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EDITORIAL

RECENT work in Dorset by the B.P. Exploration Company has revealed a show of oil encountered at about 1,800 ft. in limestone in the Broadbend No. 1 well being drilled near Kimmeridge. Drilling is to continue to a probable depth of about 4,000 ft. It is stated by the company that the well is close to a shallow hole which was put down before the war and that they were encouraged to drill again because of other indications in Southern England and also in the Paris Basin in north-east France.

IT has been announced that following negotiations between Dr. I. H. Usmani, for the Government of Pakistan, and Powell Duffryn Technical Services, Ltd., a contract has been agreed between the Government and the company for the survey of Pakistan coalfields. The main objects are to improve operating techniques at existing mines and to recommend what further work should be carried out for prospecting new areas by drilling and other means and for the development of the industry, including the better grading of coal and the manufacture of briquettes.

FURTHER investigation is to be undertaken immediately with a view to ascertaining possible routes for the Channel Tunnel. This work, to be conducted by Messrs. George Wimpey and Co., Ltd., the civil engineering contractors, has been commissioned by the Channel Study Group, which is composed of British, French, and American interests. Bore-holes are to be sunk in the seabed to obtain rock samples to 200 ft. depth from a floating craft of the type used in the Arabian Gulf. These are intended to supplement the geophysical survey made by an American company last year.

AS readers will be aware an exhibition of mining machinery is being held in London from July 9 to 18 next, promoted by the Council of Underground Machinery Manufacturers. In order to bring this event to the widest possible notice a new leaflet giving the names of the exhibitors, some particulars of the range of products to be shown, and other useful information has been distributed to associations, institutions, and individuals in the industry throughout the world. It is, indeed, to be hoped that the expectations of the promoters may be fulfilled that engineers and executives from many countries will be visiting what promises to be a comprehensive display of modern machinery designed to demonstrate the advances in mining technique and the design of equipment made in the past decade.

A USEFUL annual survey of the mineral industry [1] makes its appearance this month. Prepared by the Mineral Resources Division of the Overseas Geological Surveys, it gives details of world production, exports, and imports for the six-year period 1952–57 of the chief economic minerals and metals. As an example the tables for cobalt, copper, lead, tin, and zinc show not only the output of ores in terms of metal, but also give figures of metal production. So far as possible the latter give the amount of primary metal obtained, showing separately, wherever important, production of secondary metal. The sections on coal and petroleum are also comprehensive, including statistics of the production and trade in by-products and refinery products. As the unit for these fuels is the same, comparison is facilitated.

Co-Partnership in Africa

At a time when so much is being made of the political differences which mar the approach to Federation in Central Africa it is pleasant to record a concrete advance towards co-partnership which has been made in Northern Rhodesia. This is evidenced in an attractive booklet produced by the Rhodesian Selection Trust group of companies entitled " Kafue Flats : The Granary of the Federation," which describes the progress of a venture which after consultation with the Northern Rhodesian Government the group undertook on the south bank of the Kafue. There, near Mazubuka, a pilot polder was established two years ago, a polder which, it is hoped, may be but the beginning of a scheme to develop agriculture on a large scale in the area. The cover of the book—a coloured scene showing the harvesting of the first wheat crop by combine—shows how practical the issues have become, particularly when it is remembered that the Federation imports some £2,000,000

[1] Statistical Summary of the Mineral Industry. London : H.M. Stationery Office. Price 27s. 6d.

worth of wheat a year and at present produces virtually none. The Dutch engineers who have acted as consultants to the group envisage the flow of the Kafue dammed and stabilized and the establishment of large polders intersected with canals to provide a series of farms about 150 acres each in size. These would in rotation devote half the available land to arable crops and half to pasture. To this end a trust is to be formed to carry out the scheme—a trust which has been approved by the Government, the R.S.T. group, and Nanga Estates, Ltd. Nanga Estates is making a free gift of the land to the Trust, R.S.T. is contributing its plant and permanent improvements and has undertaken to bear the cost of operating the polder for the first six years, and the Government has agreed to appoint a Trustee.

The booklet suggests that there are three main reasons to advance this taming of the Kafue flats. These are, first, that the agriculture of the Federation must be fostered, secondly that the great river must be harnessed to provide more power, and, thirdly, the necessity of developing the co-partnership ideal. It is thought that some 15,000 African and European farmers and their families would find a living on the flats, who, in turn, would need the services of other men and women in the normal multiplying effect of any big development. The saving in foreign currency which would result from the cutting down of the country's agricultural imports would be large it is considered and it is calculated that if the full scheme were developed one out of every 35 African families in Northern Rhodesia could find a good living on the Kafue flats—roughly one family per tribal village. "On this basis alone the scheme might well be justified."

The cost involved in such a scheme is indeed high. It was originally considered that £200 an acre would be needed—a total cost of £90,000,000. The Trust now being established will have to determine how such sums can best be raised, but it is hoped that the next year or two will show on the pilot polder that the scheme is workable. Only then can detailed estimates for the work ahead be made. As the booklet says: "The cost of developing the Kafue Flats could be very high indeed. However, few who concern themselves with the future well-being of the Rhodesias and Nyasaland will dispute that the cost of doing nothing may well be very much higher."

Aluminium in Abundance

Some significant remarks of Mr. N. V. Davis, president of Aluminium, Ltd., commenting on the report for 1958, should not go unnoticed. Mr. Davis takes note of the fact that in the year under review the total aluminium smelting capacity of the "free world" was increased from about 3,600,000 tons to 4,100,000 tons, while additional capacity should be completed in the next year or so. In his view it seems likely, even with such increased consumption as is expected in the current year, that "the producing industry must look forward to a condition of oversupply . . . until a further rise in demand restores the balance." During 1958, it is noted, consumption of primary aluminium in many countries was at a high level, but in the United States, the largest single consuming area, the demand was lower than in 1957 owing to the downturn in general economic activity. Indeed, because of this, it is estimated that the total consumption of primary aluminium in the free world in 1958 was nearly 100,000 tons less than in the previous year, a reduction of some 3%. However, by the end of 1958 "there was definite evidence of recovery in demand in the United Kingdom, the United States, and Canada, while several other markets showed a continuance of the good demand levels that had held for most of the year."

Mr. Davis goes on to suggest that the present situation is not unlike that experienced by the industry after World War II; it "offers both a challenge and an opportunity to set in motion another forward surge in the demand for aluminium." With the present availability of aluminium and a resultant more favourable price relationship to many competing materials, the stage may well be set for the entry of the metal into mass-consumption markets. The research and sales development efforts of Aluminium, Ltd., are therefore being directed towards improving techniques for fabrication and utilization and this will require an expansion of semi-fabricating facilities to convert the primary metal into forms and shapes useful to manufacturing concerns. It is nevertheless felt that the demand for aluminium is increasing. Mr. Davis suggests that the economic progress experienced late in 1958 may be taken as an encouraging indication that the western world is moving to a higher level of international trade activity. His company, at any

rate, having provided the essential power and raw-material facilities to support production of 1,000,000 tons of primary aluminium in Canada, as compared with a current rate of 530,000 tons, will be in an excellent position to meet and benefit from future increases in demand.

Airborne Survey in Malaya

The Ministry of Natural Resources in the Federation of Malaya has issued as an Economic Bulletin [1] part of the Colombo Plan Report on the results of an aerial survey over parts of the country. In it Dr. W. B. Agocs, of the Canadian firm which carried out the survey, briefly reviews the practical results, while J. R. Paton, of the Federation Geological Survey, summarizes the geology. An interpretative summary by Dr. J. B. Alexander, the Director of the Survey, is also included. Mr. Paton says that for a variety of reasons—difficulty of traversing, the weathered state of the rocks, the alluvial cover, and the Emergency—the suggestion for an aerial magnetic survey in Malaya was first made by Dr. Alexander in September, 1952. It was later discussed by members of the Geological Survey and formally proposed at a meeting in Kuala Lumpur with the Far Eastern Representative of the United Nations Technical Assistance Administration. Following these discussions, Mr. Paton says, the Geological Survey later made an application to the U.N.T.A.A. for an expert geophysicist with requisite equipment to come to Malaya in order to try out on the ground the various magnetic and electrical methods and to advise, an application later split into two independent requests—one for a preliminary reconnaissance-cum-planning task by an aeromagnetic survey expert for two months late in 1953, the other for an expert with electrical resistivity and magnetometric instruments to spend six months early in 1954 to test the efficacy of geophysical methods on the ground. In response Mr. George Shaw arrived in Malaya in November, 1953, in connexion with the aeromagnetic survey planning and estimated that aeromagnetic and radioactivity survey would be worthwhile over an area of 16,120 square miles at an estimated cost of Canadian $388,000. A team of two French geophysicists later in 1954 effected the ground testing of various electrical, magnetic, and seismic geophysical methods in relation to near-surface geological problems. As the amount of money involved for the recommended survey was more than the U.N.T.A.A. had available in 1954 the project was then included in the Federation revised Development Plan, 1955–60, and an application for funds made to Colombo Plan sources. However, it was not until 1956 that Canada generously made available the sum of Canadian $200,000 and approval was finally obtained for the project to be carried through. A contract was signed with Spartan Air Services, Limited, the Federation Government providing up to the equivalent of Canadian $150,000 maximum, the balance required.

Some of the results of the work are set out by Dr. Alexander in his summary. In South Perak, he says, it is not thought that any major economic mineral deposits remain to be discovered, except perhaps in a zone west of Changkat Besout which may require closer examination. Of North Selangor, however, he says that there is a possibility of economic occurrences at depth in certain limited parts of the area, although the indications are that any such discoveries will, from the standpoint of the State economy, be relatively minor. Dr. Alexander points out, however, that the survey deals predominantly with the distribution of basement rocks and that his summary takes no special note of possible superficial deposits. An interest still lies in the possibility of western and northern extensions to the present known Batang Berjuntai alluvial tinfield. In South Selangor and West Negri Sembilan there is some evidence of mineralization over certain contact zones. Here again, however, present interest still attaches to the possibilities of alluvial tin in the Tanjong Duablas Malay Reserve and in the Kuala Forest Reserve.

Although, as will be seen from the brief account given here, first results of the survey show little prospect of the discovery of major mineralization they should be of great value in interpreting the geology of an area extremely difficult to cover entirely on the ground. Better understanding of Malayan structure and the composition of the basement must ensue and to that extent the survey may be considered to have proved its worth.

[1] Economic Bulletin 1.1. "Extract from the Colombo Plan Report on Airborne Magnetometer and Scintillation Counter Survey over Parts of Perak, Selangor, and N.S." Price Malayan $5.00.

MONTHLY REVIEW

Introduction.—The presentation of an "expansionist" Budget by the Chancellor this month may be taken as evidence of his intention to reduce unemployment as quickly as is possible. In so far as special provisions are made for particular industries, new mining works at present qualifying for a 40% initial allowance are to be granted a 20% investment allowance *plus* a 20% initial allowance, but depletion, it can be noted, is not yet to be recognized.

Transvaal.—The accounts of RANDFONTEIN ESTATES GOLD MINING for 1958 show a profit of £1,567,303 and £1,818,841 available, of which dividends equal to 4s. 3d. a share require £863,505. In its gold division the company milled 311,000 tons of ore and recovered 51,311 oz. of gold, while on the uranium side 1,870,000 tons treated yielded 1,870,794 lb. of uranium oxide and 121,876 oz. of gold. At December 31 last ore reserves in the gold division were estimated to be 424,000 tons averaging 47 dwt. over 51 in. and in the uranium division 1,677,000 tons averaging 1·2 lb. of uranium oxide and 1·5 dwt. in gold per ton.

The operations of GOVERNMENT GOLD MINING AREAS in 1958 resulted in a profit of £342,949, the accounts showing £780,283 available. After making various allowances, including the two returns of capital, a balance of £449,609 is carried forward. The mill treated 747,000 tons of ore in the year, recovering 125,249 oz. of gold, while 2,181,600 tons of slimes yielded 191,932 tons of pyrite concentrates. Ore reserves at the end of the year were estimated as 505,000 tons averaging 5·8 dwt. in value over 69 in.

The report of NEW STATE AREAS for 1958 shows an available profit of £75,048, of which £37,851 was required for the reduction of capital. In the last quarter of the year preparations were in hand for the final clean-up of gold.

EAST CHAMP D'OR GOLD MINING reports a profit of £63,624 for 1958, the accounts showing £89,069 for appropriation, of which £51,975 was required for dividends equal to 6d. a share. In the year 151,000 tons of ore treated yielded 112,461 lb. of uranium oxide and 4,268 oz. of gold.

The accounts of BRAKPAN MINES for 1958 show a profit of £229,158 and £527,103 available, of which dividends equal to 10½d. a share require £201,250. The ore milled in the year totalled 1,492,000 tons, which yielded 198,620 oz. of gold. At the end of 1958 the ore reserves were estimated to be 1,940,000 tons averaging 4·85 dwt. in value over 52·81 in.

The report of SPRINGS MINES for 1958 shows a profit of £110,024 and the accounts show £499,113 for appropriation of which a dividend equal to 4½d. a share requires £189,562. In the year the 1,500,000 tons of ore treated yielded 173,448 oz. of gold. Ore reserves at December 31 last are given as 1,510,000 tons averaging 4·39 dwt. in value over 41·96 in.

The operation of NEW KLEINFONTEIN in 1958 resulted in a loss of £10,424, the carry forward being reduced to £185,008. The mill treated 1,035,000 tons in the year and recovered 128,231 oz. of gold. The available ore reserves are reported as 1,408,000 tons averaging 3·4 dwt. over 44 in.

SPAARWATER GOLD MINING reports a profit of £14,859 for 1958, a credit balance of £142,942 being carried forward. In the year 127,800 tons of ore milled yielded 39,479 oz. of gold. Ore reserves at December 31 last are given as 263,000 tons averaging 5·8 dwt. per ton in value.

Last month NEW CONSOLIDATED GOLD FIELDS made an offer to purchase the 6% non-cumulative preference shares of the AFRICAN LAND AND INVESTMENT COMPANY at 39s. and the ordinary shares at 44s. each.

A circular last month to shareholders of NEW WITWATERSRAND GOLD EXPLORATION and MIDDLEVLEI ESTATE AND GOLD MINING announced that the directors of the two companies have under consideration proposals whereby New Wits will acquire all the assets of Middlevlei and take over its liabilities for a cash consideration which will be applied by Middlevlei in subscribing for shares in the capital of New Wits, whose authorized capital will require to be increased.

With the recent dividend notice shareholders of the ANGLO AMERICAN CORPORATION OF SOUTH AFRICA were informed that, subject to final audit, the profit for 1958 after providing for taxation is £5,890,000, of which £1,500,000 has been placed to reserve. This now stands, it is stated, at £24,500,000.

Orange Free State.—LORAINE GOLD MINES, now merged with RIEBEECK GOLD MINING, reports that Riebeeck No. 1 shaft, now re-named No. 3, is being continued. At January 31 it had reached 3,129 ft. below collar. The report states that it is estimated that the funds of the company, including an additional £1,000,000 loan from the ANGLO AMERICAN CORPORATION OF SOUTH AFRICA, will be exhausted by the middle of 1959 and, in terms of the circular issued on February 3 last, 3,072,669 shares will be offered to shareholders at a price of 20s. per share. The capital to be raised by the issue is required by the company to complete the sinking of the shaft on the former Riebeeck gold mine, to carry out further development, and to bring the Riebeeck section of the mine to production.

The accounts of FREDDIES CONSOLIDATED MINES for 1958 show a loss of £168,476. In the year the 639,000 tons of ore milled yielded 178,803 oz. of gold while the company's quota of uranium oxide under the joint scheme was 205,768 lb. At December 31 last the ore reserves were estimated as 1,088,000 tons averaging 5·5 dwt. in gold and 0·34 lb. of uranium oxide per ton.

Diamonds.—A recent circular issued by DE BEERS CONSOLIDATED MINES gives the total sales of diamonds affected through the Central Selling Organization in the March quarter totalled £23,586,653. Of this £15,865,262 represents gem material.

Southern Rhodesia.—In the March issue reference was made to the intention of MESSINA (TRANSVAAL) DEVELOPMENT, through a new company, to proceed immediately with the erection of a smelting and refining plant near Alaska, 13 miles west of Sinoia. At the annual meeting of the company last month the chairman, Commander H. F. P. Grenfell, said the plant should be in operation within the next 18 months. Through it Mangula could sell its output in the form of fire refined copper instead of concentrates, while freight and other charges will be substantially reduced. By arrangement with the Government of Southern Rhodesia Mangula would be exempt from the payment of royalty. He also referred to Alaska, a copper prospect situated within about four miles of the proposed site for the smelter. The deposit there consists of a number of sulphide and oxide ore-bodies which contain approximately 5,000,000 tons of ore of an average grade of 1·8% copper. Investigations are now complete, he said, and it is not anticipated that any difficulty will be experienced in mining the ore-bodies, while metallurgical tests indicate that good recoveries of both sulphides and oxides may be expected. It has therefore been decided to bring the property into production on an initial scale of 500 long tons of ore per day. The average annual output will amount to approximately 2,600 long tons of copper in the form of concentrates, which will be sent for treatment to the new smelter.

The accounts of the RHODESIAN CORPORATION for the year ended September 30 last show a profit of £68,073 and a total of £139,769 available, of which a dividend equal to 4d. per stock unit requires £62,150.

Northern Rhodesia.—In a notice issued early this month shareholders of BANCROFT MINES were reminded of the arrangements made early in 1958 with the ANGLO AMERICAN CORPORATION OF SOUTH AFRICA, RHODESIAN ANGLO AMERICAN, the RHOKANA CORPORATION, and NCHANGA CONSOLIDATED COPPER MINES which provided for more permanent finance for the company to replace short-term loans totalling £4,500,000 and the £3,000,000 of 5% notes in issue. The arrangements gave the company the right to repay the loans and to redeem the notes on April 1, 1959, by the issue at par of 7,500,000 6½% redeemable participating preference shares of £1 each. This has been done and it is now stated that the progress in opening up the mine reported at the annual general meeting has been maintained and development ore has been used to test all sections of the surface plant, which is operating satisfactorily. A small tonnage of copper concentrates has already been sent for smelting. Ore from stoping was to be fed to the plant on April 1 and it was anticipated that the tonnage milled would steadily increase so as to achieve the planned output at the annual rate of 50,000 long tons of copper later this year.

Ghana.—At the recent annual meeting of the ASHANTI GOLDFIELDS CORPORATION the chairman, Major-General Sir Edward Spears, revealed that development in the Ayeinm section had opened up an ore-body extending from No. 11 to No. 16 level containing 66,000 tons of ore averaging 38 dwt. Drilling below No. 16 has disclosed "extremely high values" at the No. 18 level horizon. In Ashanti mine development had been concentrated on the Main reef north ore-body between Nos. 24 and 41 levels. This had added to the reserves 242,502 tons with an average grade of 25·4 dwt. A bore-hole put

down to the No. 42 level horizon had given values of up to 36 dwt.

With the recent dividend notice shareholders of ARISTON GOLD MINES (1929) were informed that the profit for the year ended September 30, after providing for taxation, is £292,269.

Ghana and Nigeria.—Last month ALUMINIUM, LTD., announced the recent incorporation of two new companies—GHANA ALUMINIUM PRODUCTS, LTD., and NIGERIAN ALUMINIUM PRODUCTS, LTD. It is stated that all the technical and managerial resources of Aluminium, Ltd., are to be available to the two new companies. The formation of the companies is another step forward in the programme to stimulate local enterprise and broaden substantially the markets in Ghana, Nigeria, and other West African countries for locally fabricated aluminium products, such as, corrugated sheets and utensils.

Australia.—It was stated earlier this month that INTERSTATE OIL, LTD., has been advised that the formal agreement between SANTOS, DELHI AUSTRALIAN PETROLEUM, and FROME-BROKEN HILL for the joint exploration of an area in north-eastern South Australia and south-western Queensland has been concluded and drilling operations have commenced.

Shareholders were reminded at the annual meeting of MARY KATHLEEN URANIUM held in Melbourne last month that market problems for uranium would arise between the company's contract expiry dates and the late 1960's but it was reasonable to suppose that increased demand would absorb and possibly exceed the supply by 1970. Mary Kathleen was seeking new markets to absorb surplus reserves in the future. Indicated ore reserves at December 31 last, it was stated, were appreciably higher than the amount necessary to complete the company's initial contract. An independent consultant had estimated the company's ore reserves as being sufficient for continuous operation until 1972.

New Guinea.—In the three months to November 30 last BULOLO GOLD DREDGING treated 1,614,900 cu. yd. of ground and recovered 5,716 oz. of gold. The net profit for the six months to November 30 is given as $205,000.

Malaya.—It was announced early this month that the joint purchase of the mining property in Malaya of the Societe Francaise Des Mines D'Etain De Tekkah (known as French Tekkah) by GOPENG CONSOLIDATED and KINTA TIN MINES has now been completed and possession taken of the property.

Burma.—With the recent dividend notice shareholders of BURMA MINES are informed that the profit for 1958 was £56,381, before allowing for taxation.

Peru.—At an extraordinary meeting of the LAMPA MINING COMPANY held on April 1 in Liverpool it was approved that the £35,000 standing at reserve should be capitalized and that that amount should be used in paying for the 35,000 unissued shares of the company which are to be distributed to present holders.

Dominican Republic.—It was recently announced that the ALUMINUM CO. OF AMERICA (Alcoa) has now invested $14,000,000 in opening up bauxite deposits in the Dominican Republic. Quarrying operations at Aceitillar are going into full production and first shipments of ore were commenced in January this year.

Colombia. — PATO CONSOLIDATED GOLD DREDGING reports that in the three months to December 31 last 5,506,000 cu. yd. of ground was dredged and 26,218 oz. of gold recovered. The net profit for the year 1958, subject to audit, is estimated at $1,100,000. It is stated in the report for the period that No. 5 dredge resumed operations in the final quarter after shutdown on June 14 last for major overhaul.

Canada.—ALUMINIUM, LTD., reports a profit of $22,464,510 for 1958, which can be compared with $41,422,456 for the previous year. Sales and operating revenues in 1958 amounted to $422,884,184, against $453,481,880 in the previous year, while consolidated sales of aluminium in all forms were 581,195 tons as compared with 614,210 tons. The financial results of the ALUMINUM CO. OF CANADA for the year show a net income of $20,096,298 (including $8,797,505 resulting from the consolidation of a subsidiary acquired from Aluminium, Ltd., at January 1, 1958), as compared with $26,498,359 in 1957.

Shareholders of the YUKON CONSOLIDATED GOLD CORPORATION have been informed that in the 1958 season 6,130,347 cu. yd. were dredged, from which gold production of $1,671,802 was realized from the operation of seven dredges—*viz.*: Nos. 4 (Bonanza), 6 (Granville), 8 (Middle Sulphur), 9 (Upper Sulphur), 10 (Dominion), 11 (Hunker), and 12 (Dominion Benches). The hydraulic operation on Paradise Hill (No. 13) produced $115,961 and the new operation on Dominion Benches (No. 14) combining hydraulic and mechanical methods produced $104,968.

Provisional figures for 1958 (subject to audit) show that the company made a profit of $69,000 after providing for all charges (including depreciation and amortization amounting to $99,000) but before providing for taxes on income.

United Kingdom.—The operations of HALKYN DISTRICT UNITED MINES in 1958 resulted in a loss of £15,760. As already announced operations in the lead mines were suspended on April 18, 1958, having become unprofitable at the level of metal prices then ruling. Between January 1 and April 18 8,905 tons of ore were milled producing 1,031 tons of lead concentrates and 113 tons of zinc concentrates. Limestone operations were continued throughout the year and sales of limestone for industrial purposes were well maintained.

African and European Investment Co.—Preliminary figures issued by the African and European Investment Co. show that, subject to final audit, the profit for 1958, after providing for taxation, is £1,560,819 (previous year £1,305,643). An amount of £500,000 has been placed to general reserve, which now stands at £3,500,000.

Union Corporation.—With the recent dividend notice shareholders of the Union Corporation are informed that the consolidated accounts for 1958 show that after providing £700,241 for taxation there was a profit of £1,903,957, to which £845,888 brought forward has to be added making a total of £2,749,845. Of this £976,302 has been dealt with in the accounts of subsidiary companies, leaving £1,773,543 available for appropriation. The directors have written off note issue expenses amounting to £32,802, placed £350,000 to exploration reserve, and have declared a final dividend of 2s. Total dividends of 3s. per share absorbed £802,125, and from the balance of £588,616 remaining the directors have declared a bonus dividend of 6d. requiring £133,687. There is a consolidated balance carried forward of £1,291,593.

British South Africa Company.—The accounts of the British South Africa Company for the year ended September 30 last show a consolidated net profit of £4,363,217 and a total of £6,449,776 available for appropriation. Of this amount dividends equal to 4s. 6d. a share require £2,266,780, while £1,500,000 has been placed to reserve and £403,911 set aside in respect of subsidiary companies, leaving £2,279,085 to be carried forward. The company's mining revenue from royalties or other sources during the year, after providing for the Northern Rhodesian Government's interest in that revenue, was £6,120,829, which was £2,637,423 less than the total for the previous year.

British Tin Investment Corporation.—The British Tin Investment Corporation reports a group profit of £266,207. Of the £249,311 shown available in the accounts £145,250 is required for a dividend equal to 12%.

DIVIDENDS DECLARED

* Interim † Final

(Less Tax unless otherwise stated.)

†**African and European Investment.**—3s., payable May 14.
†**Anglo American Corporation of South Africa.**—6s., payable May 14.
Apex Mines.—Pref. 6·6d., payable May 12.
***Ariston Gold Mines (1929).**—1¼d., payable May 22.
***Blinkpoort Gold Syndicate.**—2s., payable May 20.
Broken Hill Proprietary.—Half-yearly, 10d. (Aust.), payable May 27.
†**Burma Mines.**—2$\frac{5}{21}$% tax free, payable May 14.
***Falcon Mines.**—4½d., payable May 8.
***General Tin Investments.**—4%, payable May 5.
Harmony Gold Mining.—1s. 1½d., payable May 20.
***Kinta Tin Mines.**—6d., payable Apr. 30.
***Lake View and Star.**—1s., payable May 20.
***Malayan Tin Dredging.**—3d., payable May 22.
***Nigerian Electricity Supply Corporation.**—3%.
***S.A. Forest Investments.**—3d., payable May 20.
***St. Helena Gold Mines.**—1s. 3d., payable May 20.
***Southern Malayan Tin Dredging.**—3d., payable May 20.
***Southern Tronoh Tin Dredging.**—3d., payable May 5.
†**Taiping Consolidated.**—15%, payable May 1.
***Tanjong Tin Dredging.**—9d., payable Apr. 30.
***Tronoh Mines.**—4d., payable May 7.
†**Union Corporation.**—2s.

METAL PRICES

Apr. 8.

Aluminium, Antimony, and Nickel per long ton; Chromium per lb.; Platinum per standard oz.; Gold and Silver per fine oz.; Wolfram per unit.

	£	s.	d.
Aluminium (Home)	180	0	0
Antimony (Eng. 99%)	190	0	0
Chromium (98–99%)		7	2
Nickel (Home)	600	0	0
Platinum (Refined)	28	10	0
Silver		6	7$\frac{3}{8}$
Gold	12	9	3¼
Wolfram (U.K.)		—	
(World)	4	6	6

Tin, Copper, Lead, Zinc } See Table, p. 240.

South African Mining in 1958

L. A. Waspe

Events in a year of consolidation are critically reviewed

Gold and Uranium

While there was a further advance in gold output in 1958 comparative statistics indicated a rounding off of the uptrend due mainly to declining production by the older mines offsetting the higher output and grade of the new mines in the south-western Transvaal and the Free State. In addition there was a certain measure of consolidation on the part of the new mines, while preparations were further got under way for the third phase of operations—namely, the extension underground of reef development, sinking additional shafts, providing greater ventilation capacities, expanding gold plant treatment capacity, and, wherever possible, raising milling rates. Power supplies were again generally adequate and water requirements were fully covered, while the railway transport position posed no special difficulties. Regarding European personnel short-falls were recorded mainly in the technical categories, in the artisan complement, and, with particular reference to the more distant future, in the recruiting of official and mining trainee personnel. The native (African) complement remained generally below requirements, notwithstanding the marked unseasonal increase in the latter months of last year over the corresponding 1957 levels; from January to December, 1958, the native complement of the Chamber of Mines members ranged from 314,239 to 329,234, against 323,837 to 299,132 in 1957.

Over 1958 most of the gold mines recorded increased costs per ton and slightly less than half recorded lower costs per oz. Last year's advance in working costs finally eliminated the residual devaluation benefits of 1949, so that many mines were operated at profit margins approximately equivalent to the annual average increase in costs per ton. These constitute the marginal producers, which almost generally contracted operations, effected possible economies, occasionally closed down shafts and/or plants, and in some cases resorted to treatment of surface accumulations of development ore and sands residues from earlier operations.

One of the most vulnerable zones is the East and Far East Rand, where of the original 25 mines seven have already closed down and another 10 or 11 are expected to follow suit within the next decade. Measures proposed to alleviate the problems of the marginal mines have embraced reduced rail tariffs on certain supplies, re-organization of training within the industry, re-organization of native (African) hospitalization, and relief from certain rates and assessments. The position of the marginal mines has been and is being studied with the object of prolonging operations as long as possible, to stagger closures and thereby avoid local economic dislocation. By 1966 the Witwatersrand gold output will decline to about 3,500,000 oz. from 8,700,000 oz. according to estimates.

To encourage new exploration last year's Budget provided that attendant costs incurred by mining companies could be set against general income—a measure which also encourages these companies to continue in existence. The southern Free State region was initially surveyed for possible mineral deposits, while drilling in the Waterpan Block (south of the West Rand) was completed by Johannesburg Consolidated Investment with favourable results. Drilling was also continued in the general Potchefstroom area where interest again moved north to the Ventersdorp–Coligny zone.

In addition Johannesburg Consolidated Investment, Anglo-Transvaal, and New Witwatersrand companies combined in a broader agreement to continue exploration in the Doornhop area of the Roodepoort district, West Rand. Preparations for drilling in the Reitz area of the Northern Free State were reported. Greater interest was expected to be forthcoming in exploring further the area

immediately south of the Vaal River, opposite the Buffelsfontein mine, in the deep-level zone south of the St. Helena–President Brand–President Steyn mines, and in ground adjoining the Merriespruit mine, where reclamation was advanced sufficiently to facilitate the resumption of reef development early in 1959. A gold discovery in the Jameson district, Eastern Cape, was reported.

The application of job-reservation to the gold-mining industry was sought in 1959 by the Mine Workers' Union, which called for a declaration of work to be reserved respectively and essentially for Europeans and non-Europeans.

An important factor in the year's operations of the new mines was grade beneficiation and expansion of effective treatment capacity by intensified waste sorting on surface, which also effected economies in uranium operations. Apart from this beneficiation, Harmony, Free State Geduld, Western Holdings, Loraine (through its higher-grade Riebeeck section), St. Helena, and possibly Buffelsfontein appear the most likely to raise their mill grades further as operations are extended. Harmony's shaft-systems are adequate for operations many years ahead, Free State Geduld sank an upcast ventilation shaft, Western Holdings completed a third shaft system, President Brand completed a sub-vertical shaft, and, like President Steyn, prepared to sink a third shaft system. Welkom advanced the deepening of its two original shafts, sank or planned to sink ventilation winzes, and virtually completed its joint shaft system. Buffelsfontein equipped its ventilation shaft for hoisting and prepared to sink a sub-vertical shaft to extend operations. Stilfontein deepened its original main shaft where hoisting capacity was increased and another eastern shaft was being planned. Hartebeestfontein virtually completed two shaft systems, planned sinking another in the deep south-central section, and considerably modified its ventilation system including sinking a circular winze. Virginia deepened both shafts while Free State Saaiplaas, with production scheduled for mid-1960, virtually completed its first two shafts. Vaal Reefs mine prepared to sink a second deep-level shaft and St. Helena completed its third shaft and planned sinking a fourth, primarily for ventilation. Loraine's Riebeeck shaft is expected to be completed by about mid-1959. West Driefontein completed the third of its four shafts in the northern shallow section and completed the vertical component of its fifth deep-level shaft system. Doornfontein prepared to sink a deep-level sub-vertical shaft and may extend its lease area in the higher-grade south-eastern section. Blyvooruitzicht planned the sinking of a second ventilation shaft to facilitate extension of workings to greater depth and completed preparations for eventually sinking a deep-level shaft system in the south-eastern section.

Of the non-producers Winkelhaak completed its first phase of shaft sinking and commissioned its plant for initial gold output. Western Deep Levels recorded fast progress in sinking its two twin-shaft systems in the shallower northern section and these may eventually be connected with the deep-level workings of West Driefontein and Blyvooruitzicht. Zandpan initiated sinking its first shaft.

Among the " mid-life " mines production was generally maintained with isolated advances recorded by Marievale and Vlakfontein. South African Lands extended development into its northern Withok section, where results have been encouraging but where clarification of the southern section is expected in 1959. Other mines in this category were engaged in extending operations, often to greater depth, here and there by shaft-sinking and in some cases by exploring beyond present boundaries. In the case of East Rand Proprietary Mines ultra-deep operations probed to the 11,000-ft. level and are projected to 12,000 ft., possibly deeper, the whole programme involving extension of the shaft systems, expanded ventilation and refrigeration capacities, and the erection of a new centralized gold plant.

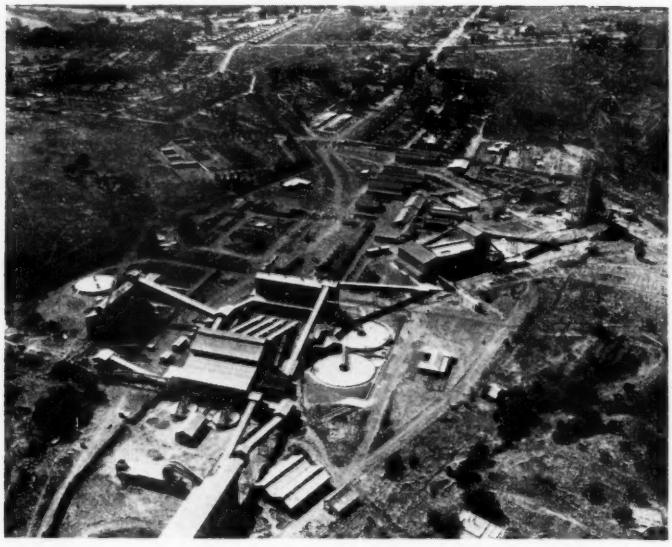
With the extension of operations in the new goldfields, where the average temperature gradient is higher than on the Witwatersrand and where operations are proceeding to and at greater depth, ventilation is receiving high priority and research into pneumoconiosis intensified. The merits of circulating massive quantities of air and of exercising closer control over the distribution of smaller quantities combined with expanded refrigeration capacities are being more closely studied. Research into the effects of heat on work capacity and performance has been intensified and improved methods of acclimatization are being studied. Tests continue on new types of air filters and of underground electrostatic filter units to improve efficiencies and performances. Increased technical

No. 1 Shaft, President Brand.

preference was shown for twin-development ends. In that they can be driven faster than a single end of equivalent capacity, they provide better ventilation, facilitate mechanical mucking (lashing), and provide better ground support. Improved ventilation in development ends is being supplemented by " spot-coolers " or mobile refrigeration units.

During 1958 any expectation of an immediate expansion and extension of the uranium project was ended by the imposition of a ceiling output sales quota of 6,200 tons of U_3O_8 a year, excluding the additional Harmony contract with the United Kingdom nuclear authorities. Slight sales declines in 1959 will be recorded by individual producers, except Dominion Reefs, the joint Welkom–President Brand–President Steyn–Loraine–Freddies Consolidated project, Hartebeestfontein, Virginia, West Rand Consolidated, the Randfontein–East Champ D'Or project,

Surface Layout, President Steyn.



Premier Diamond Mine from the Air.

Blyvooruitzicht, which have slightly increased quotas, and in particular Harmony. The aggregate output capacity of the individual plants exceeds the aggregate quota. In the West Rand zone from East Champ D'Or to Randfontein the mines have virtually become uranium producers with gold a by-product. Harmony increased its uranium and pyrite plants handling capacities to 120,000 tons a month and started the erection of its sulphuric acid plant. Taxation of uranium profits, so far on the gold tax formula, is being studied and the Government's decision whether it will be possible to lighten the impost is awaited.

Diamonds

A late rally in 1958 lifted the year's total value of diamond sales above that for 1957. Quiet concern had been felt about the future relative position of South Africa as a diamond producer. To maintain and if possible improve this position large-scale prospecting was advanced by the two major producers—De Beers and the Government. In the Kleinzee Annex area of Namaqualand the former's prospecting disclosed 6·75 carats per 100 loads in a lease area of 20,000 claims where production was being planned. The company was also planning exploration in other areas of Namaqualand. South of the State Diggings at Alexander Bay on the Namaqualand coast, where the scale of operations were being expanded, the Government advanced exploration in an extensive tract of Crown Lands.

At Kimberley the De Beers company interconnected workings of two mines and completed a joint shaft. Generally, in its mines there, the company is extending the use of block-caving methods of mining. A new centralized treatment plant with a handling capacity of 21,000 loads a day was commissioned to deal with ore from all its Kimberley mines. The programme is expected to raise efficiencies and effect economies.

One of the minor companies initiated development for small-scale production in the Western Free State. Another, in the Western Transvaal, effected economies and improved the mine's position with a view to expanding output and raising the extraction.

The Tanganyikan Government and the De Beers company each acquired a 50% interest in Williamson Diamonds, Ltd., in Tanganyika, where expansion of output to the quota of 10% of world production was put in hand.

Base and Industrial Minerals

Especially in the export markets, 1958 was a disappointing year and declines were widespread in output and value.

Asbestos.—Particularly in physical terms and in production asbestos returns were more than maintained last year. New outlets contributed to this and included the use of the fibre as insulation in nuclear plants.

During the year the long-term outlook for South African production was described as satisfactory, providing higher costs did not force selling prices to uncompetitive levels. Producers were officially urged to interest themselves more in the domestic production of finished asbestos products for both internal and external markets. Certain chrysotile producers attributed lower exports to currency restrictions in Europe and South America and to barter deals between various European Governments and Soviet Russia.

South African producers took advantage of the lull to place their mines in a better position technically to meet any revival of demand. In some cases development disclosed favourable results, a special investigation in one case yielding results justifying further exploratory development operations. In the Pietersburg area (amosite and Transvaal blue) a major group acquired and consolidated under single control several small producers. Another important group increased its holdings in the area and expanded output. Another company initiated exploration of the Graskop deposits.

Manganese.—Generally supply and transport facilities were being expanded at a time when exports were declining. During 1958 one of the two major producers acquired a new lease area. The other initiated the establishment of a new mine on a new lease area and capacity output is scheduled for mid-1959. A number of small producers in the Postmasburg area were merged under centralized control. At Cato Ridge (Natal) two furnaces for producing ferro-manganese were being installed with a further six furnaces scheduled for the next 15 years or so. A South African company secured manganese rights over 9,000 sq. miles in the Bechuanaland Protectorate, where exploration and exploitation were initiated.

Chromite.—Adverse conditions in export markets were not relieved and production contracted on the suspension or scaling down of output by some producers. Producers with long-term contracts appeared to maintain the level of their operations. One company extended its chromite interests.

Copper.—In the Cape the O'okiep Copper Co. scaled down operations to 83% of capacity owing to the metal market conditions and placed its immediate capital expenditure programme on a priority basis; its ore production capacity was expanded to the rate of 150,000 tons a month. The Messina (Transvaal) copper company introduced further economies to offset metal market conditions and incorporated electronic control equipment in its Transvaal mill. Its base-mineral interests in Southern Rhodesia were extended and operations there were placed under the control of a newly formed Rhodesian subsidiary.

Platinum.—In its 1957–58 year Rusten-

Diamond Concentrate Passing Over Grease Tables.

Coal Sorting, Springbok Colliery.

burg Platinum Mines reduced output to the level of sales, which amounted to 50% of the 1956–57 monthly average due to adverse metal market conditions. These militated against commissioning additional plant capacity installed. Net revenue from metal slumped to £1,519,000 from £4,481,000 and Transvaal Consolidated Lands' platinum property remained on a caretaking basis.

Iron Ore.—Production again advanced, mainly in line with expanded ingot steel output capacity by the major producer, the South African Iron and Steel Industrial Corporation, which aims at an output capacity of 2,350,000 tons by 1961–62 and probably also with increased pig-iron output by other producers.

Miscellaneous.—In the 1958–59 year, declines in the traffic of certain commodities were expected by the railways to be offset by increased traffic in coal and iron ore, with that in manganese ore and chromite not expected to deviate materially, especially on long-term contracts, from the 1957–58 export levels. Beyond that period traffic estimates took account of the willingness or otherwise of producers to sell at prevailing prices, especially outside contractual supplies. Depending on the availability of capital the railways programme of expansion should be completed by about the end of 1961. Taking into consideration the recession and consequent release of carrying capacity the railways recently stated that the available aggregate capacity had become adequate for all present requirements. Port Elizabeth was being equipped as a major ore export harbour.

The Phosphate Development Corporation completed lengthy test runs of its flotation plant on its low-grade copper ore and resumed the output of igneous phosphate concentrates. Phosphate mining operations were extended while the sale of the corporation's copper deposits was being negotiated.

Both the two major tin producers—Rooiberg and Zaaiplaats—have placed their mines on a better footing; plants were modified and/or modernized and provision made for extended operations.

Consolidated Murchison (antimony) curtailed operations owing to market conditions. Exploration begun in sections between known ore-bodies with promising results was scaled down, but milling was progressively stepped up as the year progressed.

Umgababa Minerals initiated production on the Natal South Coast with projected output rates of 100,000 tons of ilmenite a year, 10,000 tons of zircon, and 7,000 tons of rutile.

Northern Lime stepped up output at the Silverstream works and reduced it at the overloaded Taungs works, where plant modernization was put in hand.

Extensive and unusually consistent deposits of calcium-magnesium montmorillonite (bentonite) were discovered, apparantly identical with similar deposits in the southern United States. Extensive high-grade kaolin

deposits in the Bitterfontein area of Namaqualand were opened up to supply domestic and export markets. Commercial production of abrasive equipment is being considered following favourable tests of Transvaal corundum.

The field operations of the Mineral Development Division of the Mines Department were suspended for economy reasons, the Geological Survey Division of the Department assuming responsibility for mineralogical investigations and identifications of ores and rocks.

The Johannesburg Metal Exchange was formed and affiliated with the London Metal Exchange and the Johannesburg Stock Exchange, with membership representative of the country's economic structure.

The office of Mineral Search of Africa (of the Rio Tinto group), which is interested in the Palabora Mining Co. (holding copper interests in the north-eastern Transvaal), has been transferred from Johannesburg to Salisbury for closer contact with the group's head office in Southern Africa.

Coal.—With the domestic requirements of coal remaining on the uptrend 1958 production and sales again increased notwithstanding various difficulties experienced by the industry. These were associated partly from the loss of its higher priced export markets. This loss again meant working on a lower average profit margin which was also adversely affected by rising production costs. Although improved, rail transport facilities were again below requirements and the availability of trucks remained erratic on the whole. The native (African) complement—often below requirements—fluctuated markedly. Mainly to offset this, mechanization was extended notwithstanding the high capital costs involved and the narrowing profit margins. In most cases this extension was effected to and, in fact on average did, raise output with the available labour complement. While in a few cases expansion or development of replacement reserves was deferred for the reasons mentioned, in general operations were extended into new areas, usually adjoining existing workings. In a few cases increased washing plant capacities were provided or projected. Some collieries provided or extended surface stockpiling and loading facilities and expanded ventilation capacities. A few collieries modernized or modified crushing and/or screening plants. Late in the year pithead prices were increased in the three coal-producing Provinces to a level providing a more equitable profit margin, relative to the conditions mentioned.

Competition for native (African) labour remained keen enough to necessitate the provision of better conditions where possible. On the whole, the shortfall in the native complement is expected to continue. Further mechanization involving considerable capital expenditure is therefore anticipated.

Vryheid Coronation Colliery, Natal.

An important new development was the decision of African Explosives and Chemical Industries to use low-grade Transvaal coal in existing and expanded production of ammonia gas instead of metallurgical coke, the reserves of coking coal being thereby conserved.

Subject to the condition that the total time or cycle of firing must be less than a maximum of about 90 milliseconds, tests showed that millisecond blasting could be successfully applied to coal-mining. The method is now in limited operational use.

The Natal anthracite producers initiated a programme of expansion in expectation of being able to export larger tonnages through improved rail facilities. Contract standards are being more rigorously enforced to counter keener competition in export markets. A larger storing and loading site in Durban harbour was acquired and is being equipped.

The oil-from-coal project in the Northern Free State, which should reach capacity output by about 1960, reported that one of its two synthesis plants was mainly the cause of rated output not being reached. Partly associated with metallurgical and material difficulties, the problems are being investigated on an international plane. The eventual erection of a second and third oil-from-coal project is being mooted, as well as expansion at the existing plant after 1960.

South-West Africa

Almost without exception the returns of South-West Africa's mining industry in 1958 reflected the adverse conditions in the export markets, on which it is heavily dependent. With the object of the programme of expansion being reached, the output of Consolidated Diamond Mines rounded off its uptrend and then fell away on the economic factors. Modification and modernization of plant and equipment continued but at a reduced level of capital expenditure, according to unconfirmed reports. A larger heavy-media separation unit was installed and heavy-media treatment was modified to improve the recovery. Construction of the new grease-belt recovery section was started. On appeal, Consolidated Diamond Mines was upheld in its contention that its mining rights included the 180-mile long coastal strip between high- and low-water marks from the Orange River mouth to Luderitz in the north. The company contributed £100,000 to establish technical educational facilities in the territory.

De Beers Consolidated Mines initiated diamond mining operations on a small scale in one of three concession areas in the Kaokoveld. Industrial Diamonds converted its operations in the Saddle Hill area to dredging, which may be extended to the coastal strip held by the associated Diamond Dredging and Mining Co., as well as inland terraces at or below sea-level. Dredging would substantially reduce costs to the order of 12d. from 43⅓d. per load for conventional methods. The Diamond Dredging company secured prospecting and mining rights over the coastal strip seawards from the high-water mark 180 miles northwards from the Walvis Bay area. This same company acquired the controlling interest in Moly-Copper Mining and Exploration Co., which has a substantial shareholding in Lorelei Copper Mines, has mining rights north of the Orange River and east of the Consolidated Diamond Mines property, and extensive prospecting rights adjacent to the Lorelei holdings.

Tsumeb Corporation extended its flotation circuit, but the South Africa Minerals Corporation suspended production of manganese ore in the closing stages of the year, although development was continued to build up the ore reserves—an operation which would provide tonnages for sale and cover costs thereof and of prospecting which was being advanced further. The previously worked Khan Copper Mine in the Swakopmund area was re-opened for small-scale production.

Bechuanaland

No new mines were opened up in the Bechuanaland Protectorate during 1958. However, the stage was being set for what is hoped will be a marked expansion of mining activities in the future. Negotiations proceeded for the granting to the Rhodesian Selection Trust group of a mineral concession (the main interest being directed towards copper and coal deposits) over the whole of the Bamangwato Reserve. Two companies exhibited interest in obtaining regional prospecting rights over the Batawana and the Bakgatla Reserve. An application was received for a Crown grant of manganese rights in the southern Crown Lands area north of the Molopo River. An extension of a Crown grant for another 20 years was accorded the Marble Lime and Associated Industries group over manganese deposits in 9,000 sq. miles in the Bangwaketse Reserve;

exploration was advanced and is being continued and small-scale production initiated and export sales effected. Apart from this no Crown grants were issued.

The year's operations included the following: Reconnaissance geological mapping of the Protectorate was continued; systematic geological surveying was advanced in the Bamangwato and Bakwena Reserves; water development again claimed considerable emphasis and high priority, and mineral rights owned by the British South Africa Co. in the eastern districts of the territory were prospected by the Anglo American Corporation on behalf of De Beers Consolidated Mines, mainly in the Tuli Block and the Gaberones areas. In the Bamalete Reserve the Bechuanaland Protectorate Mining Corporation suspended operations in December at its Ramoutsa manganese mine, partly because the average grade is not high and the silica content is appreciable. The company switched to exploring a high-grade deposit located in the Ootsi Mountain in the south-western section of the Reserve. Near Kanye, in the Bangwaketse Reserve, the Moshaneng chrysotile mine expanded production. Two asbestos occurrences—one about 20 miles south of Serowe in the Bamangwato Reserve, chrysotile fibre developed in serpentized dolomite; the other, silicified crocoolite in lower Griquatown banded ironstones on the Molopo River north bank in the southern districts—were drilled with disappointing results. The Survey Department's coal survey work was confined by staff shortages to assistance rendered operating mines and largely to detailed examination of two coalfield areas.

Work completed in the Morapule area, west of Palapye, has disclosed persistent carbonaceous development with, however, considerable lateral variation: the better quality coals having calorific values of 11·5 lb. to 12 lb./lb. and ash contents of 12·6% to 14·4%. Drilling was started in the Mamabula coalfield east of the Mamabula siding on the Rhodesia rail-line with encouraging results; shaft-sinking is proceeding to secure bulk samples from two seams. In the Tati Concession the Halfway Kop kyanite mine was closed down where a considerable tonnage of low-grade ore is still available but where the high-grade lenses have been worked out.

Prospects of new ventures being actively pursued depend entirely on current negotiations for prospecting rights, but 1959 is expected to see increased prospecting by various mining companies. Chrysotile output should at least be maintained. Manganese ore production should expand further.

Airborne Radiometric Surveying

Its place in future exploration for radioactive minerals

A. Hatton, B.Sc.[1]

In the past decade speed has been in many cases the essential part of prospecting for radioactive minerals and quite naturally airborne surveying has been extensively used to that end. As far as can be ascertained world supplies of uranium are likely to exceed demand during the next few years. Nevertheless it is unlikely that the price of oxide will fall below a reasonably economic level since the great nuclear powers would be unwilling to accept the large reduction in supply which extensive mine closures would bring about. In any case those countries whose stated intention is to introduce the extensive use of nuclear power might, for economic and possibly other reasons, be reluctant to depend more than was absolutely necessary on supplies of fuel from the two or three main producers in the western world.

[1] Hunting Geophysics, Ltd.

Prospecting for nuclear fuels and minerals necessary for the operation of reactors will therefore go on and in some countries be intensified. In the immediate future, however, as in all other mineral search the emphasis will be on the economics of such exploration. This will be effected in part perhaps by the introduction of new techniques but most by rendering the present methods more effective.

The papers read at the Second United Nations International Conference on the Peaceful Uses of Atomic Energy (1)[1] show that most authorities now consider that in certain areas airborne scintillation counter surveying is a desirable first step in the assessment of the radioactive mineral potential of an area or in de-limiting the zone(s) of interest in areas already known to be mineralized. Improvements have been and are still being made in the airborne techniques which, under the right conditions, will allow the method to play an even more effective part in radioactivity surveying than in the past.

The sensitivity and stability of the scintillation counters developed specially for air survey use have been improved and now efforts are being made to render such surveys more selective. Sensitivity is being increased mainly by the use of larger phosphors and the consequent improvement in the statistics of the counter ensures that small but probably significant anomalies are less likely to be lost in " background." Increases in sensitivity and stability have made possible the introduction of some degree of selectivity into the method. In the attempt to differentiate between characteristic radiation from potassium, uranium, and thorium use is being made of the gamma ray spectrograph which analyses an anomaly in terms of levels of energy as well as in total flux intensity.

Operators in France (2) and America (3) have reported that in some areas this method has been used with success. Generally, however, it must be stated that interpretation of data obtained from such surveying is most difficult especially in areas of mixed uranium and thorium sources. A somewhat different discrimination technique now under consideration in the United Kingdom could be a further aid to accurate interpretation of spectrum analysis of this kind.

A further way in which selectivity may be obtained is by the use of two sensitive detectors at different heights above the ground (4). This has been done in the U.K. by placing the second detector in a specially designed " bird " which flies below and behind the detector in the aeroplane. Care has to be taken to determine within narrow limits the spatial relationship of the two detectors under varied flight conditions. Making certain assumptions about the relationship of count rate to height from various types of sources it is often possible to determine what type of source (point source, line source, extended source, etc.) is causing a certain anomaly thus providing further useful information to the interpreting geologist. In addition, most spurious anomalies due to solid angle effects can be detected using the two detector techniques and as the height separation between the two instruments remains constant the " height above ground " variations, unavoidable to some extent during any air survey, become much less important assuming that the height above the ground is known and that a realistic coefficient of air absorption is available.

The planning of airborne surveys is becoming more efficient as the knowledge of the known deposits becomes more widely known—*e.g.*, a study of dispersion phenomena around uranium deposits indicates that in some semi-arid or arid areas a wide and consequently very economic line spacing can be effectively used (5). As the components making up the background count become more clearly understood control procedures can be applied which give a better chance of repeatability than has been possible in the past.

Thus modern radioactivity surveying from the air is becoming increasingly efficient as are the geophysical, geochemical, and geological ground techniques and a combination of all the methods will continue to be used in efficient surveys for economic radioactive minerals.

[1] A list of references appears at the end of this article.

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Rising Using a Platform Elevator

O. W. Nilsson

The author reviews the use of a drilling platform elevator in mining

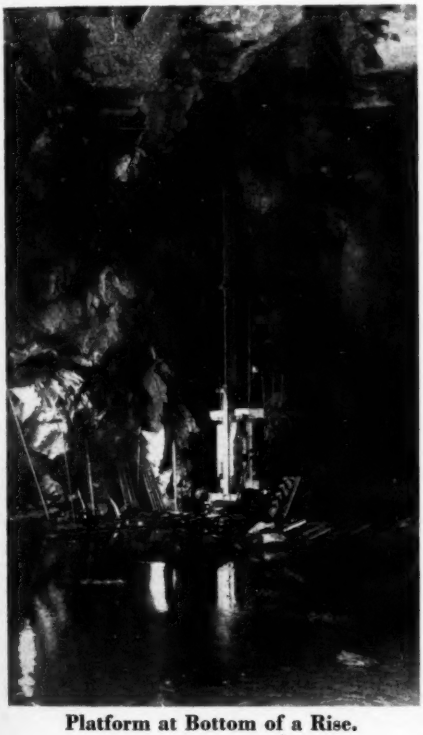
Introduction

In the February issue of the MAGAZINE new equipment recently introduced to this country by a British company[1] was described in some detail and last month it was demonstrated at a quarry in Derbyshire.[2]

Use in Sweden

This machine has lately been used for putting up rises at a number of Swedish mines and power stations and by the new method practically all expensive timbering and heavy forged hardware have been dispensed with. Rise-driving has also, it is suggested, become a much easier and less risky job as miners need not climb to an uncleared roof carrying machines and materials.

[1] A.C.E. Machinery, Ltd., Brentford, Middlesex.
[2] Breedon-on-the-Hill, by courtesy of the Breedon and Cloud Hill Lime Works, Ltd.



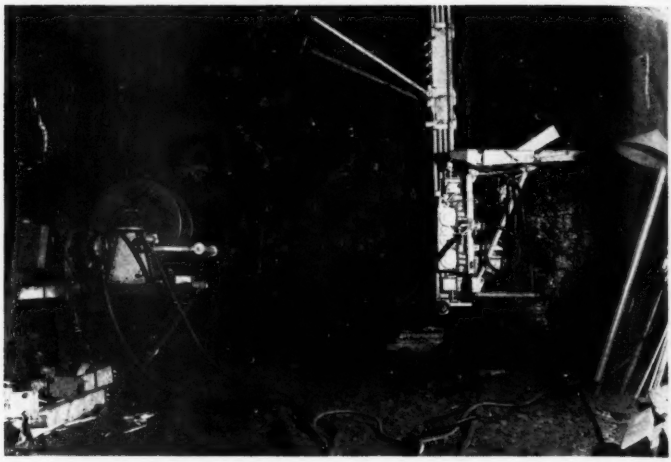
Platform at Bottom of a Rise.

The new drilling platform elevator, as already described, climbs a rack-equipped guide rail fastened to the rock face by means of expansion bolts. The guide rail is built up of sections 2 metres long and can be extended as the driving goes on. The elevator consists of a welded platform driven by a compressed-air motor, the upper tread surface of the drilling platform being double panelled. Tubular inserts are welded into both panels to form through holes in the platform, serving as mounting points for drills, stopers, etc.

The safety measures of the drilling platform elevator include a protecting bell, which can be moved and rotated as the work proceeds, railing standards, special climbing irons, and telephone communication between the working platform and the tunnel floor. In order to allow of manual lowering of the elevator if the compressed-air supply fails, the elevator is provided with a disc brake arrangement operated from the driver's seat.

To put a vertical rise with the new method an opening is first drilled and blasted in the roof of the tunnel, while at the same time a recess is blasted out of the rock into which the elevator may be withdrawn before the blast. The platform can be used in vertical as well as inclined rises. In the latter case the guide rail is generally mounted on the hanging-wall. If the rise is steeply inclined a different type of elevator driving seat can be fitted.

In all those mines and power stations where the new method has been practised it has proved superior to all conventional methods. In some mines the speed of rise driving has been increased by 50%, chiefly owing to the fact that all the loss of time while climbing ladders damaged by falling rubble carrying machines and other equipment has been eliminated. The greatest

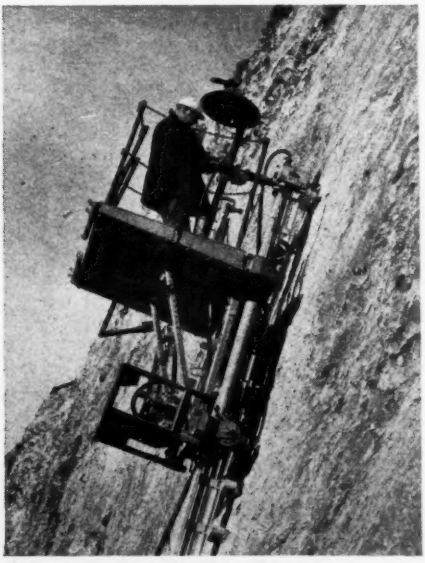


Complete Equipment Underground.

advantage of the method, however, according to engineers, lies in the possibility of putting up rises of practically any length. At Bolidens Gruvaktiebolag a rise of more than 130 metres has been completed and much longer ones are contemplated.

Demonstration

At the demonstration in Derbyshire the platform had been transported to the quarry face on its trolley. There, as it were, on the side of a rise the rock face was trimmed with a CP 22-lb. pneumatic pick and a vertical timber bed erected for the guide rail. This was mounted by drilling eight bolt holes with a CP 32F drill and eight expansion bolts of a type and length suited to the rock material were driven and tightened with a CP 36ORP impact wrench. Air and water hoses were brought to their connexions at the mounted guide rail. With the platform supported on the rail and mounted on the rock face the trolley was wheeled away. The operator on the platform was then able to drill more bolt holes and fix more sections of rail. Under actual mining conditions a recess is blasted out at the floor level so that the platform, together with hinged bottom rail section, can be folded under the overhanging rock pentice while blasting operations are carried out. During this time the top of the guide rail is protected by a guide-rail head box which contains valves and outlet fittings for compressed air and water, electric firing cable connexions, etc. The guide-rail head box cover also contains a valve for ventilating the shaft and after a round has been fired air and water are thoroughly mixed to remove all traces of the explosion gases. This blowing out is controlled from the tunnel floor. After about half an hour the operator can safely mount the platform to clear the rock face.



Rising on Quarry Face.

The demonstration illustrated that when clearing the rock face the operator is protected from falling lumps of rock and debris by the bell cone fitted to the platform.

Similarly, while ascending the operator sits on a seat under the platform for further protection. A man-hole cover is fitted to the platform which can be opened from above or below. Clearing completed, a further rail section is added and the cycle repeated. The equipment is considered equally suitable for vertical and inclined shafts and special curved rail sections are available for use where the rise changes direction.

Germanium in Rectifier Construction

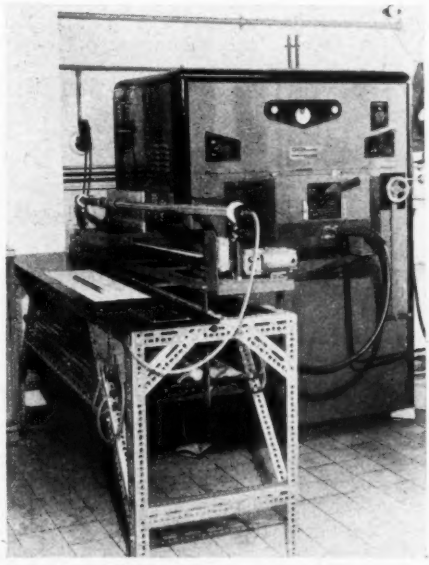
The use of semi-conductor materials in an engineering works.

Introduction

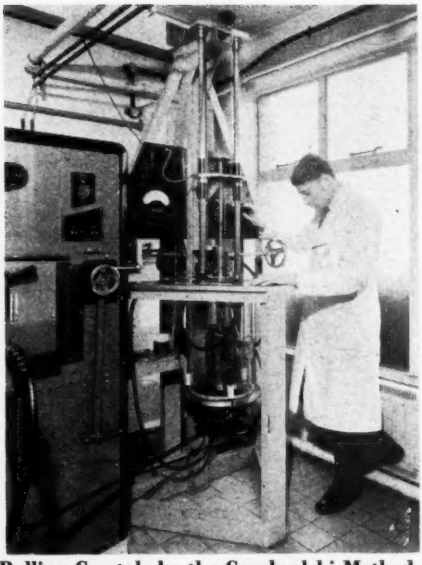
Some notes on the preparation of germanium crystals for use in the construction of rectifiers employing semi-conductor elements for low- and medium-voltage applications have recently been put out by the Hackbridge and Hewittic Electric Company, of Walton-on-Thames. This company has now in full production an extensive department for the complete manufacture, assembly, and testing of germanium diodes of the air-cooled and water-cooled types for use in Hewittic rectifiers. This plant has been arranged in a new extension.

Since the correct working of the diode, it is stated, depends upon the presence of small amounts of known impurity elements it is necessary, before such elements are added, to start with extremely pure germanium. To this end zone refining is used, an ingot of germanium and its containing crucible being placed under a hydrogen atmosphere in a long quartz tube. This tube is surrounded at intervals by three R.F. work coils arranged to travel together slowly from one end of the ingot to the other, so causing three molten zones about 1 in. wide to move along the bar in one operation. Any impurities present tend to remain in the liquid metal rather than move across the liquid-solid interface at the trailing end of the zone, which results in their being swept to the end of the bar.

The presence of impurities is detected by resistivity measurements made along the axis of the bar whereupon they can be removed by cutting off the end at a suitable point. Such measurements are made at regularly-spaced intervals on a line ground along the back of the ingot, the germanium being brought into contact with four independently-sprung and accurately-spaced probes situated in the instrument head. The outer probes pass a controlled current of 1 milliamp and the resulting volt drop on the inner probes is measured by a sensitive reflecting type galvanometer directly calibrated in ohm cms.



Zone Refining Germanium Ingot



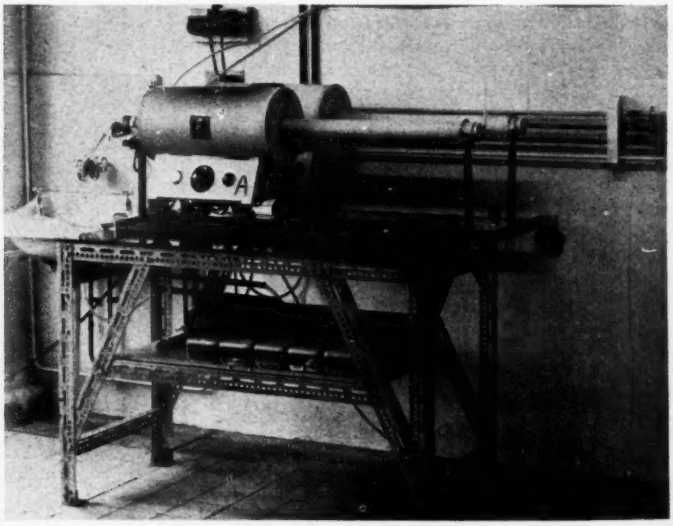
Pulling Crystals by the Czochralski Method.

Single-Crystal Metal

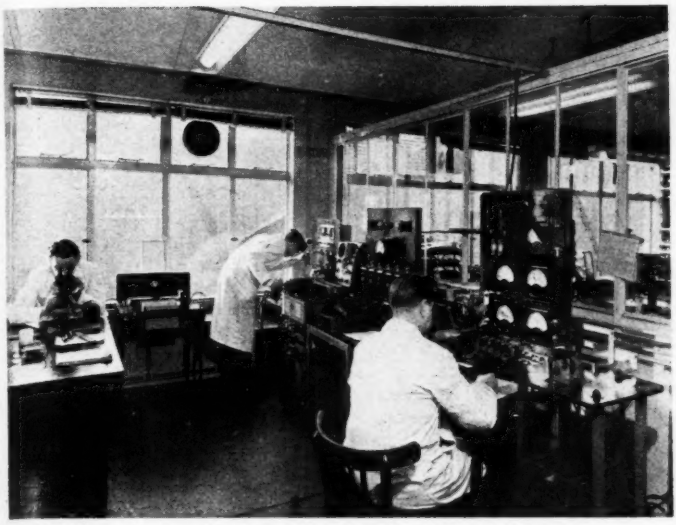
To produce an ingot of metal which is wholly single crystalline it is necessary to control solidification atom by atom. This is achieved in a special machine in which the germanium is first melted in a cup-shaped quartz crucible by means of an R.F. work coil supplied at 400 kilocycles per second. A long thin piece of specially-prepared single-crystal germanium (the seed) is then lowered into the surface of the molten metal. Carefully controlled conditions permit the temperature to be high enough to melt the tip of the seed and low enough for a meniscus of liquid germanium to be held up from the molten metal by surface tension forces. The temperature loss through the chuck of the machine securing the seed causes the solid-liquid interface to move slowly down from the seed into the general mass and, when a sufficient diameter of solidification has formed around the tip of the seed, the seed is slowly and continuously raised. This results in a growing column of solid germanium being pulled up from the melt to be left hanging from the seed as a single large crystal.

The operation is carried out in an atmosphere of specially dried high-purity hydrogen which results in the formation of clean bright crystals. Seed rotation and pulling is effected by constant-voltage motors and the seed spindle and main plate are water cooled, initial seed dipping being effected manually. The introduction of antimony to produce an "N" type crystal is done during crystal growing by adding to the crucible a carefully calculated and weighed amount of that metal.

The completed crystal is shaped into a square-sectioned stick and cut into 0·03-in. wafers by means of a small precision diamond



Twin Furnace Alloying Bench.



Testing Room.

saw of the type used for cutting diamonds. Both surfaces are then lapped to bring the thickness to 0·02 in. Every wafer used is centred on the crystal centre so that its isorhos are concentric. This gives the beneficial result of a symmetrical current density pattern. Finally, the discs are cleaned and given the necessary surface finish by etching in acids, washing in running de-ionized water, and drying by infra-red heaters.

Rectifying Junction

At this stage the rectifying junction is made. On one side of a disc of N-type single-crystal germanium a slightly smaller disc of indium is placed and the whole is brought up to a temperature greater than the melting point of indium (155° C.) but less than the melting point of germanium (980° C.). The germanium and indium wafers are loaded and jigged in graphite blocks in batches and alloyed inside quartz tubes under an atmosphere of hydrogen—as with zone refining and crystal pulling. The electric furnaces surrounding the tubes are arranged so that they can be temperature stabilized before being moved along the tubes to the positions where alloying is to take place. This results in junctions of very regular characteristics and simplifies the controls required.

The liquid indium quickly dissolves germanium up to saturation point and upon cooling the dissolved germanium precipitates out of solution and recrystallizes back on to the base germanium. This recrystallized layer of germanium now contains a larger number of indium atoms than it originally did of antimony atoms and has now been converted to " P " type so that it forms a rectifying junction with the N-type base germanium.

Diode Assembly

The rectifier junction has to be protected against contamination from all likely industrial atmospheres and to this end it is hermetically sealed in a glazed ceramic tube, which also serves as an insulator between the anode and cathode terminals. The tube is attached to the copper heat sink after the latter has been treated by abrasive vapour blasting for cleaning and finishing. Encapsulating of the junction in the heat sink is carried out on plastic-topped benches in an air-conditioned room in which a high standard of cleanliness is maintained. Before the final seal is made the diode is cleaned with specially filtered compressed air and finally vacuum dried.

In the case of the air-cooled type the diode is made as an integral whole with the junction soldered directly on to the heat sink-cooling assembly ; there are no separate cooling fins or attachments. By this means a low thermal resistance is assured and hot spots are avoided.

At the works electrical measurements and testing are carried out in a specially equipped test room, where routine tests of reverse and

forward characteristics are made for the purpose of grading each diode. This is followed in every case by a load test in a single-phase, half-wave, resistance load circuit, during which the diode is tested according to its grading. In addition, by means of a special circuit its on-load reverse current is observed and recorded. Each diode receives a serial number and its characteristics are registered for future reference.

Ore-Dressing Notes

(13) *Progress.*

Magnetic Separation

The use of magnetism in ore beneficiation dates back to 1792, when Fullarton obtained a British patent. The property of magnetism depends on the unbalanced spin of atoms which occurs with elements having an odd number of electrons and iron, for instance, contains millions of such atoms in small aggregates or domains. Information on the magnetic properties of ore minerals, however, is comparatively scant. In dry separation the usual aim is the removal of a minor fraction of magnetic material from the desired end-product, although a useful and growing volume of direct upgrading of ferromagnetics exists. Much of the pioneer work was done on dry ores, but wet treatment now dominates the magnetic beneficiation of iron.

Discussing the subject of dry separation L. A. Roe[1] notes its important use on nepheline syenite, kyanite, quartz, aplitic rocks, and feldspar. The Blue Mountain deposit in Ontario, Canada, for example, has grown in importance as a producer of nepheline acceptable to the ceramic industry in place of feldspar since 1935, from which date high-intensity magnetic separation has been successfully applied. Work starts with a low-intensity drum separator of large diameter, which removes the stronger ferromagnetic particles as a concentrate assaying 50% *plus* Fe. This is followed by the use of high-intensity separation with induced-roll equipment. Some 75% of the original feed (2% Fe) reports as a final product containing less than 0·08% Fe. Among the advantages claimed for dry separation are avoidance of handling water (from 500 gal. to 1,000 gal. per ton are used in wet treatment) and a higher-grade magnetic product.

In the last century T. A. Edison consistently produced 68% Fe grade concentrates in his New Jersey plant. A free-fall system was used in the deflection of magnetite from gangue with four separators in line. Head ore at 12% to 20% Fe was upgraded to 68% Fe. Inadequate ore reserves and the discovery of the Mesabi deposits led to the failure of the enterprise.

Interest is, however, reviving strongly in dry beneficiation of iron ores. At Otanmaki in Finland the Laurila separator treats, after drying, the magnetic concentrates from the wet plant. Centrifugal force throws weak and non-magnetic particles from a rotating drum, whence they go to flotation for their ilmenite, while the adherent material is treated to recover its vanadium. The Laurila separator is undergoing further development, trouble with lubrication and shell having been experienced at the operating temperature (120° C. to 140° C.). At first fatty acids and other reagents were used to aid drying but this has been discontinued. At Salzgitter (Germany) a 30-in. dry-drum separator treats 5 tons an hour of haematite-goethite ore in a field of 23,000 gausses with a consumption of 1 kWh per ton and the Ontario series of separators was described in the MAGAZINE for June last. With the growing realization that cost of ore is less important than cost of finished steel and of the price paid in smelting cost for an undue percentage of silica in the pelletized taconite fed to the furnace, the reviving interest in dry magnetism may be expected to expand.

[1] *Min. Engg.*, Dec., 1958.

(14) *Production.*

Phosphate Flotation

The plant at Orange Park, Florida, which commenced operations in May, 1957, is located in the Land Pebble field, which contains the largest known deposit of high-grade rock phosphate.[1] The phosphate beds or "matrix" are the residual concentrates of a shallow basin laid down in past ages and they vary in thickness from 5 ft. to 20 ft., under from 4 ft. to 50 ft. of overburden. They consist of about equal proportions of clay, sand, and phosphate. A year's draining of the swampy surface is customary before exploitation, ditches and low-head pumps being used. The residual slimes settle slowly and 1½ acre-

[1] *World Mining*, Feb., 1959.

feet are needed for every acre-foot mined. Material excavated by drag-lines is dumped at the pump sump ahead of the mill, where it is slimed by means of hydraulic monitors working at 150 p.s.i. pressure, Slurry pumps and monitors are mounted on skids and moved to new sumps by tractors when needed. The slurry at 40% solids is moved by pipeline to the plant, with relay pumping where required. There the feed proceeds through three basic sections—washing, feed preparation, and flotation—each of which recovers a product. Phosphate pebbles (*minus* ½ in. *plus* 14 mesh) are separated at the washes, where clay balls formed in transit are screened out, broken down by hammer milling, and slurried back to the head of the section. The *minus* ½-in. undersize receives further screening and log-washing to yield washed pebbles and from these operations the *minus* 14-mesh material goes to the feed preparation section at 14% to 18% solids. There treatment starts with dewatering in cyclones, which overflow *minus* 150-mesh slimes at 4% to 6% solids, these being discarded to the slimes settling area. The spigot product at 60% to 75% solids is screened and classified, the *plus* 20-mesh material being a finished product. The *minus* 20 mesh *plus* 65 mesh is the coarse flotation feed and a third group at *minus* 48 mesh is the fine flotation feed, the two being binned separately.

The Cyanamid flow-sheet is unique in handling this rather coarse material by straight flotation in pneumatic cells. Feed from the coarse-feed bin is sent to a rake classifier, from which the coarse fraction (*minus* 20 *plus* 65 mesh) is conditioned in a rotary mixer with fuel oil, tall oil, and caustic soda, the classifier overflow going to the fine-feed bin. From this bin the *minus* 65-mesh material goes to bowl classifiers and similar flotation agents are added at the rake discharge. It is then conditioned and floated in pneumatic cells, overflow from the bowl classifiers being run to the slimes settling area without further treatment. Both coarse and fine flotation circuits are roughed to produce a clean tailing with high recovery. As a consequence, sand is floated with the phosphate. These concentrates now join for their final cleaning. This commences with sulphuric acid agitation, dewatering in cyclones, and a two-stage rinse. Final concentration is made in mechanical flotation cells after conditioning with Aeromine 3037 and kerosene to procure selective flotation of the silica.

Controlling the Crusher Feed.

(15) *Control.*

Homestake-Partners Uranium Mill

Part of the impact made on mineral dressing by the growth of uranium treatment has been the spectacular increase in the use of instrumental controls. New methods have been devised to meet new problems particularly as unfamiliar conditions have had to be administered by untrained workers. In a recent paper Carl Marquardt [1] suggests that as competition increases and the free market in uranium concentrates approaches, the mill with a maximum of process control and a minimum labour cost will be at an economic advantage.

Homestake-New Mexico Partners treats 750 tons daily of sandstone ores and was designed with a strong emphasis on automatic control. Six plant processes are worked by instruments and push-button control from central panels and 29 continuous recording instruments take care of 272 functions. In each filter tank, for example, is a bubble tube which controls the setting of an inlet valve to the filter pneumatically, while at the same time the level in the head mixing tank which supplies the filter is maintained constant by varying the speed of the underflow pump from the thickener. When the

[1] *Min. Engg.*, Sept., 1958.

filter is newly covered and can handle more than its normal load the speed of the thickener underflow pump is increased and its storage reduced, but, as the filter cloth begins to blind, the level controllers on the filter tank close the valve on the filter supply line. The level in the agitator tank then rises and this causes its level controller to slow down the thickener diaphragm pump. The thickener then withholds part of its slime and as a consequence the ratio of sand to slime is increased. This in turn makes filtration more easy. With a new cloth the filtering rate increases and the diaphragm pump is speeded up, thus removing stored slime from the thickener.

Pachuca leaching is controlled by temperature recorder-controllers which vary the addition of steam to the leach tanks and maintain a uniform pulp temperature. In addition, crushing and sampling are controlled from a single panel, the plant having three ore-handling circuits. First is the coarse crushing, sampling followed by fine crushing, and conveying to the fine-ore storage bin. The second operation is coarse crushing, sampling, and conveying to the truck bin for stockpiling sampled coarsely-crushed ore, while the third operation is the reclamation of previously-sampled ore from the stockpile. The operator uses a selector switch to choose the condition to be employed.

The grinding circuit is also automatically controlled. Recording and integrating weighing scales measure the feed into the ball-mills and dilution in the ball-mill is controlled by means of the flow recorder controller. In addition, power input to the helix of the spiral classifier is measured and converted to a pneumatic signal, which sets the control overflow meter regulating the addition of mill solution to the ball-mill feed. The whole system gives an optimum ball-mill density at all times. The bubble tube pipe control keeps the specific gravity of the classifier overflow correct.

Precipitation of uranium from the pregnant leach liquor is aided by a flow meter which adjusts the addition of sodium hydroxide to the volume of liquid entering the precipitation tanks. In the four-hearth dryer which follows the fuel supply to each hearth is monitored by the temperature on the third hearth, which is caused to regulate the flow of gas automatically. Even the mill water supply is automatically controlled from the power house by a scanning system that works the pump in the supply well.

The Far East in 1958

Malaya

As a result of the International Tin Council's decision to restrict exports of tin from the six countries taking part in the international agreement Malaya shipped out only 45,695 tons of tin metal during 1958. This is shown in figures issued by the Straits Trading Co., Ltd., of Singapore. The firm's figures include a comparatively small amount of metal from sources other than the Federation of Malaya. Such shipments in 1958 were thus about 35% down on those for 1957, when 70,681 tons were exported. In addition to Malaya the countries in the agreement are the Belgian Congo, Bolivia, Indonesia, Nigeria, and Thailand.

Although the operation of the control scheme brought the six countries' rate of production well down the scheme received a severe blow when Russia unexpectedly exported substantial quantities of tin. According to reports from various sources exports from the Sino-Russian bloc were at the rate of about 18,000 tons per annum. Several member countries of the international agreement accused Russia of " waging a tin war," while as 1958 was nearing its end there was another surprise. Allegations were made that the International Tin Agreement was being broken, a Bangkok report saying that an official investigation had been ordered into allegations that 1,400 tons of tin ore had been shipped from Thailand in " suspicious circumstances."

Malayan mining leaders continued to urge the Government to adopt a " more realistic " land policy to help the industry to find new tin-bearing areas. Mr. K. J. Cumming, president of the Chamber of Mines, said that a very liberal land policy was needed for the well-being of the industry or there would be a devastating effect on the economy of the country. He added : " I am one who believes that Malaya still has considerable hidden resources of tin." Later a deputation of mining leaders met Tengku Abdul Rahman, the Federation of Malaya Prime Minister, in Kuala Lumpur and said that mining land was being exhausted ; unless new land was alienated the industry would be in danger. The deputation asked that the Government should speed up the procedure for alienating tin land and for assisting in prospecting, since Malaya's jungles, it is thought, cover various other untapped mineral resources, including iron ore, the possibilities of which have been

probed by, among others, some Japanese experts.

A (Malayan) $50,000,000 iron-mining project is to be developed in the jungle of south Pahang State. It is planned to produce ore by 1964 and will have sufficient equipment to enable 2,000,000 tons to be exported from Malaya every year if there is the demand for it. Some 17,000,000 tons of high-grade iron ore are said to exist in the area. This project was announced by Mr. J. N. McHugh, a director of the Rompin Mining Co., which is a subsidiary of the Eastern Mining and Metals Co., Ltd. He was negotiating to obtain equipment from Japan and to supply iron ore to the latter country.

Malaya's iron ore is exported almost entirely to Japan and is therefore subject to the vagaries of supply and demand in that country. Mr. Henry T. Wong, secretary of the Associated Chinese Chambers of Commerce of Malaya, said in Kuala Lumpur that one of the difficulties confronting the iron-mining industry in Malaya is the absence there of smelting facilities. This brought up the question of coal, which is available only from one mine, at Batu Arang in Selangor State. Although considered to be basically suitable for iron-ore smelting the coal from Batu Arang, he said, was situated too far away from mines.

Borneo

Reserves of oil in British Borneo—almost entirely concentrated in the Seria field of the Brunei Shell Petroleum Co., Ltd.—are estimated to be at least 300,000,000 barrels, and there are favourable prospects of finding more oil in 20,000 sq. miles of British Borneo. This is the outlook as given by Mr. F. W. Roe, director of the Geological Survey Department in the British Territories of Borneo.

Other Borneo developments were that the Shell company began drilling of the 500th well to be sunk at Seria and it was announced that a 4,000-ton drilling barge would commence, in 1959, an extensive under-sea search for oil off the coasts of Brunei, Sarawak, and North Borneo.

Indonesia

A tin smelter is being planned for Indonesia according to an Antara report, in order to make it unnecessary for the country to have the ore smelted abroad. Mr. Ingkiriwang, the Minister of Industries, was quoted at the end of 1958 as saying the smelter would be constructed not far from the Banka and Billiton tin mines. Mining news generally from Indonesia in recent months has been scrappy owing to the rebellion there.

China

Ever-growing heights in production figures continue to be reported from China. The target of 10,700,000 tons of steel in 1958 was said recently to be "certain of being passed." Now it is planned to develop a network of small furnaces using modern methods. Already great numbers of them are reported to have been merged into some 8,500 production centres, which are integrated iron and steel plants in embryo. Where large-scale industry is concerned a blast-furnace bigger than any in Britain or the U.S. was completed at Anshan in November, it is reported.

Coal production figures are given as 221,000,000 tons for the period January–October, 1958, whereas the total in the whole of 1957 was 130,000,000 tons.

The 1958 schedule called for an output of 1,550,000 tons of crude oil, but it was expected that the production estimate of between 5,000,000 and 6,000,000 tons for 1962 would be exceeded by a wide margin.

India

In addition to the Government's ambitious steel development programme, which currently covers three 1,000,000-ton steel plants under construction, private interests are also expanding production.

During the course of the hunt for oil successful tests were made at Cambay, in Bombay State, and Mr. K. D. Malaviya, Minister for Mines and Oil, said, in September, that it would be necessary to continue fairly intensified drilling and testing for a period of roughly three to 12 months before they could be certain as to whether they had struck a commercially exploitable field. Dr. M. S. Krishnan, special officer in the Geological Survey of India, said he expected India to attain self-sufficiency in oil in another decade.

Pakistan

Work on geological survey in both wings of Pakistan with a view to make new finds of minerals was intensified. The country's first steel plant, at Multan, is expected to go into production by the end of 1961.

The Pakistan Government decided to grant special concessions to undertakings engaged in the exploration and extraction of minerals in the country.

Loading Nitrate into Blast Holes

In order to mechanize the loading of fertilizer-grade ammonium nitrate the Atlas Powder Company, of Wilmington, Delaware, has developed the " Jetloder," a blow-loading machine which uses compressed air to blow the blasting agent and also sand stemming into blast holes. Working tests have demonstrated that the machine, as now developed, can blow 2½ lb. of ammonium nitrate and diesel oil mixture per second into a 50 ft. to 50 ft. horizontal blast hole ; four 80-lb. bags were loaded into one hole in 2 min. Hand loading of the same material in the conventional way by a three-man crew with jointed tamping poles would require about 30 min.

The only basic equipment required for use with the Jetloder includes a compressor to provide air at 45 lb./sq. in., a truck or other device to move the compressor and blow-loading machine and supplies, and a sufficient length of 1½in. (ID) plastic pipe to reach from the machine to the back of the blast holes.

The blow-loading machine is unique in that it has no moving parts except the closing device and the valve which admits air. In one of a series of recent tests at a large Ohio stripping operation a crew of three men primed, loaded, and stemmed five holes varying in depth from 75 ft. to 90 ft. in 1 hr. 30 min. Each hole was primed with 80 lb. of Atlas Gelodyn No. 1 in 2-in. diameter Twistite cartridges screwed together to form a continuous primer 40 ft. long. Detonating fuse was connected to the outer end of the primer and the primer column was inserted to the back of the hole. The plastic pipe of the Jetloder was placed in turn in each hole and a total of 2,320 lb. of ammonium nitrate was mixed with oil and blown into the holes. The bags of ammonium nitrate were emptied directly into the machine. One gallon of diesel oil was poured into the machine simultaneously with each 80-lb. bag of ammonium nitrate, with the Jetloder doing the mixing during blow loading, 10 ft. to 15 ft. of sand being then blown into each hole for stemming. The holes were detonated and excellent fragmentation resulted, it is reported. This and other tests show that the blow-loading machine offers promise as a method of automating the charging of horizontal high-wall blast holes. While the time and labour saved will vary with different operating conditions, considerable savings may be expected. Experiments are also being conducted to determine the economy of using the Jetloder in vertical hole work. Work done so far seems to show that the blow-loading method achieves greater density, which can generally be expected to improve the breakage in ammonium nitrate shooting. In addition, recent experiments seem to indicate that a 1¼ in. diameter continuous primer of special high-velocity high-strength gelatin can be used, thereby further reducing costs and improving results.

" Jetloder " in Use.

Engineering Log

A new electronic tracer has come on the market which uses pencil or ink-line drawings to control single or multi-torch flame-cutting machines. Advantages over the mechanical type of tracer are that the photo-electric cell of the scanning head allows the tracer to follow ordinary pencil or ink lines and that the tracer is equipped with an automatic kerf compensator which makes allowance for the width or " kerf " taken out by the cutter. All special preparations—such as, metal or plastic templates, photographic negatives, or silhouettes—can be dispensed with, the manufacturers claim, and the photo cell will not respond to light or

shadow falling accidentally on the lines of the drawing. The machine is said to be capable of following closely-spaced lines more accurately than can a mechanical tracer, so that intricate metal shapes and small holes can be cut with the unit. At average speed the tracer will negotiate 90° turns with a $\frac{1}{16}$-in. radius; it travels at the rate of 2 in. to 30 in. per min. The tracer will follow lines which cause the cutting torches to move uninterruptedly from one series of shapes to another for purposes of chain cutting. Once used, it is pointed out, drawings can be filed more compactly than can templates of rigid plastic, hardwood, or plywood. Before the machine is operated a dial is set for the thickness of the plate to be cut. Automatic kerf compensation then follows and parts can be reproduced without calculation of kerf width on the drawing.[1]

* * *

At Hadera, in Israel, a new scheme is afoot to make paper from Indian corn stalks. About 18 miles north of Tel Aviv, en route for Haifa, the American Israeli Paper Mills are pushing ahead to use this new raw material, a waste product of local agricultural industry, perhaps for the first time in this application. Pilot-plant studies in the United States revealed that corn stalks resemble sugar cane, already used by several Latin-American countries for paper-making. In the new pulp mill under construction cereal straw, another agricultural waste product, could also be used. Experience obtained from the use of imported straw pulps shows that Israel's dependence on expensive wood pulps from abroad could be reduced by this means. Engineers on the project were faced with various problems. One was the removal of the soft pithy centre of the corn stalks, another the bulk handling of such voluminous material. These have now been largely solved. An elaborate system of water flumes will be used to float the baled corn stalks to their appointed place before the processing begins, which solves the initial transport problem. The pith is to be used as an auxiliary boiler fuel. Corn stalk and cereal straw is expected to make up from 20% to 100% of the product, depending on the kind of paper to be made. Imported wood pulp will still be needed to the extent of some 50% of the mill's raw material intake. Cotton stalks and sugar cane are likely to be added to the materials used and the new mill is adapted to take them. This is the first major pulp mill in the Middle East and since Israel now ranks third among the world's book publishers on the basis of a *per capita* count there is every indication that each corn stalk will be needed by her growing population with its growing use of paper.[1]

[1] *Comp. Air Mag.*, Feb., 1959.

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In a newly-established radio-isotope laboratory established at the United States Bureau of Mines Research Centre in Salt Lake City radio-isotopes of cobalt, iron, nickel, and beryllium are being used successfully in experiments to improve methods for extracting essential metals from raw materials that are difficult and expensive to treat. These radio-isotopes promise to lead to more efficient metallurgical techniques, permitting utilization of materials that cannot be processed economically by present methods. The isotopes employed by the Bureau—cobalt 60, iron 59, nickel 63, and beryllium7—were supplied by the Atomic Energy Commission's Oak Ridge installation. The isotopes are being used to trace reactions and evaluate process effectiveness in selectively recovering these metals from complex solutions by a "solvent-extraction" process. Results thus far have been so encouraging, the Bureau said, that orders have been placed for radio-isotopes of three other metals—rubidium, caesium, and scandium. Each of these is in demand for important research in defence or nuclear-energy programmes and all present difficult problems in extraction from their ores.[2]

* * *

At Stanford Research Institute, Menlo Park, California, a simple method for collecting radioactive particles from the upper atmosphere for subsequent measurement has been made possible by use of a superfine fibre filter. The radioactive particles which fall to earth are only one of the problems of fallout and many particles are so light that they remain suspended in the atmosphere. These are frequently less than a micron in length. Although filters for collecting such particles have long been available, making the filters has required costly and complex equipment. The new

[1] *Science News Letter*, March 7, 1959.
[2] P.N. 51223.

filter has high purity and is of a non-metallic, organic character allowing accurate measurement of the trapped particles. The filter itself can be burned away, leaving the radioactive particles intact for analysis. Manufacture of the device is simple. A solution of polystyrene in methylene chloride solvent is sprayed through a fine nozzle. The solvent evaporates almost instantly, leaving thread-like fibres 1 in. long and less than 1 micron thick. The spray force directs these fibres into a 2-ft. square dacron mesh mounted vertically at a distance of about 2 ft. from the spray nozzle. These fibres build up into a superfine filter mat with very high collection efficiency and reasonably low resistance to air flow. 99·5% of the particles are retained. The filter and procedure were developed for the United States Air Force Cambridge Research Centre.[1]

* * *

Throughout its history the human race has found noise distressing. Dr. Vern O. Knudsen, physics professor at the University of California in Los Angeles and a leading expert in the acoustical field, is of the opinion that the increasing noise of modern life may constitute a threat to life itself. He points out that in Roman days complaints were heard about the rattling of donkey-carts on cobblestones. While a cart going to market may have disturbed the early morning sleep of Roman city-dwellers, to-day the level of noise frays our nerves and impairs our hearing constantly and it may, if increased still further, prove fatal. During the last 30 years the loudest noise to which men have been exposed has risen in intensity from about 120 to 150 decibels, an average increase of 1 decibel per annum. A noise level of 160 decibels is fatal to such animals as mice and rats. The intensity of the sound raises the body temperature of these animals to an intolerable and fatal level. With the arrival of our jet age noise intensity has been and is likely to be aggravated. Dr. Knudsen feels that some measure of protection from the noise danger must be provided by architectural means. Sound insulation, quieter motors, fans, and electro-mechanical generators, and also the control of reverberation and resonance can all play their part in protecting man from this new hazard.[2]

[1] *Comp. Air Mag.*, Feb., 1959.
[2] *Science News Letter*, Feb. 28, 1959.

Until recently it seemed that the trend towards motorization and the alleviation of the farmer's work load would stop short of the small-holding. Mechanization of farming appeared to be operating in the large farm group only. The introduction of the single-axle tractor has changed the situation however. Where the small size of the holding or the mountainous nature of the terrain precluded the use of a four-wheel tractor the single-axle tractor has enjoyed a wide distribution, developing from its ancestor, the motor-mower, in a relatively short space of time. One Swiss firm, producers of the first horse-drawn mower with ball-bearings in 1932, has marketed a versatile single-axle tractor with four forward speeds for mowing, traction, and tilling. With 20 attachments the machine ranges over a wide programme of mechanization for the small-holding. Used with an angled-share plough the tractor will draw a furrow up to 10 in. deep by 12 in. wide. A rotary harrow can be attached and a multi-purpose device makes holes for planting tobacco, maize, and potatoes and covers up, hoes, ridges, and rows. Autumn crops of beet and potatoes are raised by means of a spinning digger attached in front of the tractor. A swathformer is available for haymaking, as well as wiches, sprays, and ground mill and muck chopper. The makers claim that mountain slopes are negotiable and the problems of traction over sodden ground overcome by the attachment of a well-loaded live-axle trailer, giving four-wheel drive. A drawbar with seat operates tedder, rake, roller, and drill.[1]

* * *

The National Aeronautics and Space Administration, the agency responsible for the non-military space activities of the United States, has released some of the details of Project Mercury, the Administration's manned satellite programme. Preliminary information was given with the announcement that McDonnell Aircraft Corporation will be the source for the final design, development, and construction of the capsule. The capsule as planned at present will be a truncated cone with short cylinder attached at the point of truncation: in general appearance it will resemble a cathode-ray tube. The cone's base diameter will be approximately 7 ft. and the whole will weigh about 1 ton, it is expected. Nickel alloy or

[1] *Swiss Technics.*, March, 1958.

titanium may be the construction material used. The satellite will have high aerodynamic drag, will be non-lifting, and will be built to withstand any known combination of acceleration, heat loads, and aerodynamics that could occur during launching or re-entry. The leading face will be extremely blunt and covered with a heat shield, probably of beryllium. Three antennas are to project from the cone's sides and while a porthole will allow the pilot to make direct observations other devices will give him a view of parts of the earth and sky. During acceleration a couch will support the pilot. Pressure, temperature, and atmospheric composition within the capsule will be kept within the bounds allowable for human beings and food and water will be provided. Since orbit time at 24 hours is short it is thought that problems of pilot maintenance will be met by techniques already used in jet fighter planes. Instruments, including perhaps a television camera, will evaluate the pilot's response and data will be telemetered to ground recorders. In addition to instruments needed for the pilot's welfare a two-way radio will be included and devices to measure and monitor environment within and without the capsule, and to make other observations, to the extent permitted by space and weight limitations. Dual control system will allow the capsule to be controlled by pilot or ground station or by both combined. The pilot will have the option of manual or automatic control once in orbit. The proper attitude for orbit will be established by the pilot or the ground station through small pitch, yaw, and roll jets. No specific information on launching vehicle and booster has been released, but the basic inter-continental ballistic missile, such as the Atlas, is likely to be used, with such modifications as will have been introduced in the two to three years which Project Mercury requires.[1]

Book Reviews

The Geology of Uranium. Cloth, quarto, 128 pp., illustrated. Price 48s. New York : Consultants Bureau Inc. ; London : Chapman and Hall, Ltd. 1958. [Translated from the Russian **Voprosy Geologii Urana.** Paper, octavo, 160 pp. Price 9 roubles. Moscow : Atomizdat, 1957.]

The English title of this compilation of a dozen scientific papers translated from Russian is somewhat of a misnomer, for only three of the contributions deal with uranium geology whilst six are concerned with mineralogy, two with radio-assay work, and one with aerial radioactivity surveys. None is significantly new. The most important geological paper, on uranium in Jurassic coals, has already appeared in English, in a somewhat improved form, in the Proceedings of the second Geneva Conference[1]; and in the same place will be found rather fuller accounts of most of the new mineralogical discoveries than are presented in the work under review. Sometimes these data conflict strangely with recent American determinations.[2] The paper on aerial surveying is merely a summary, now largely outdated, of earlier reports published in Britain and North America.

The two other geological papers, both on disseminated uranium ore deposits in sedimentary rocks, ascribe such mineralization to syngenesis followed by a reworking and redistribution under metamorphic conditions. The text is not at all explicit, partly because all mention of ore values and of localities, as well as all geological maps, have been omitted for security reasons. In one of these papers the Russian term *nasturan* is correctly translated as pitchblende but throughout the other it appears as uraninite (and once as uranite). A table giving spectrographical analyses of uraninite for trace elements is as meaningless in the English translation as it was in the original Russian.

The price of the translation is eight times the London price of the Russian paperback at the time of its first publication. This more costly format tends to attribute to the contributions an importance they do not all possess ; and the Western reader should be warned that, to assess the quality of recent Russian researches on uranium ores, he should look not to this volume but to the many outstanding contributions by Soviet scientists which appear in the published proceedings of last year's International Conference in Geneva.

C. F. D.

[1] *Science*, Jan., 1959.

[1] *Proceedings* of the second International Conference on the Peaceful Uses of Atomic Energy : Vol. 2, Survey of Raw Material Resources. Geneva : U.N.O. 1958. Price 132s.

[2] "Systematic Mineralogy of Uranium and Thorium." By CLIFFORD FRONDEL. *Bull. U.S. Geol. Surv.* 1064. Paper covers, 400 pp., 1958. Price $1·50.

Second Symposium on Coal Preparation: Department of Mining, University of Leeds, Oct. 21 to 25, 1957. Cloth, octavo, 513 pages, illustrated. Price 20s. Sheffield: Coal Preparation Plant Association.

This volume, well produced and illustrated, contains the 18 papers presented at the Second Symposium on Coal Preparation, held in the University of Leeds in 1957, together with discussions, addresses, and the summaries prepared by the rapporteurs. The volume is opportune in its appearance in that the rôle of coal in the national economy has changed markedly over the past year or so. At the time of the first of these symposia, held in 1952, the sale of coal presented no difficulty; output was the thing, easily absorbed in expanding industry. Nowadays, with the demand for quality, coal preparation is coming into its own since as machine mining tends to produce the quantity in dirtier condition the dressing engineer has the task of providing a coal that sells without difficulty. The papers and discussions presented in this volume serve to show him a clearer way to his task and other engineers the manner in which the problems arising are likely to be solved.

Quin's Metal Handbook, 1958. Pocket size, 600 pages. Price 27s. 6d., post free. London: Metal Information Bureau, Ltd.

The present edition of "Quin's Handbook," the 44th, sustains its usual comprehensiveness. In its 600 pages all the references on ores, metals, iron and steel, and scrap have been revised and brought up to date while there is in addition a presentation of much relevant information relating to prices, production, consumption, exports, imports, destinations and sources, brands and stocks of non-ferrous metals, minerals, scrap, iron and steel, ferro-alloys, tinplates, blackplates, and galvanized sheets. Covering many countries this is concisely indexed so that quick and easy reference to any metal in any part of the world is readily available.

☛ Copies of the books, etc., mentioned under the heading "Book Reviews" can be obtained through the Technical Bookshop of *The Mining Magazine*, 482, Salisbury House, London, E.C.2.

News Letters

VANCOUVER

March 11.

Placer Development, Ltd.—Placer Development, Ltd., and its partly-owned subsidiaries, Bulolo Gold Dredging, Ltd., and Pato Consolidated Gold Dredging, Ltd., have called extraordinary meetings of shareholders to consider a resolution empowering directors to appoint a trust company to act as principal transfer agent in Vancouver for capital stock. Mr. J. D. Simpson, the company president, has pointed out there is no change to be made in branch transfer agents in Montreal and Toronto, while the Sydney, Australia, office of the company will continue to act as transfer agent in respect to shares registered there. The transfer company to be named in Vancouver, if the proposal is approved, would act as disbursing agent for the payment of all future dividends to shareholders other than those listed in the Sydney register.

Gazette.—A recent issue of the *B.C. Gazette* has listed the following companies as having been struck from the British Columbia register:—

Cliffview Colliery, Ltd., Douglas Distilleries, Ltd., Gold River Syndicate, Ltd., Haludun Mines, Ltd., Harris Creek Placers, Ltd., Hottah Lake Uraniums (1955), Ltd., Jado Mines, Ltd., Kasmer Prospectors, Ltd., Keefers Explorations, Ltd., Lardeau Tungsten, Ltd., Lillooet Mining and Dredging Co., Ltd., Lincoln Mining Co., Ltd., Linda Silver Lead, Ltd., L.M. and N.L. Mining Co., Ltd., Magnusson Mines, Ltd., Mincor Mines, Ltd., Mineral Development Co., Ltd., Mission Petroleums, Ltd., M.J. Mining Co., Ltd., Mundus Mines, Ltd., North American Exploration, Ltd., Norwest Resources, Ltd., Okanagan Minerals Exploration Co., Ltd., O. Kay Mines, Ltd., Oro Mio, Ltd., Out-West Oils, Ltd., Pacific Coast Oil, Ltd., Pacific North West Mines, Ltd., Para Uranium, Ltd., Pelly River Explorations, Ltd., Penticton Tungsten Mines, Ltd., Pinehurst Uranium Mines, Ltd., Premium Petroleums, Ltd., Providence Mines, Ltd., Rambler Enterprise Mines, Ltd., Regent Uraniums, Ltd., Richrock Mines, Ltd., Rosea Copper Mines, Ltd., Samson Mines, Ltd., Sanca Silver Lead, Ltd., Silver Glance Mines, Ltd., Siwash Development Co., Ltd., Skyline Mining and Development Co., Ltd., Stikine Tungsten, Ltd., Stoney Creek Placers, Ltd., Straits Mining and Refining Co., Ltd., Sweet Grass Oil (B.C.), Ltd., Tesla Copper Mines, Ltd., Tungsten of British Columbia, Ltd., United Metals and Petroleums Corporation (B.C.), Ltd., Utility Gas and Oil Reserves, Ltd., Vikka Oils, Ltd., and Western International Explorers, Ltd.

Alberni.—During the operating season from May 1 to December 20, 1958, the Empire Development Co., Ltd., produced 305,000 wet long tons of iron concentrate from 510,000 long tons of ore mined; some 264,500 tons of overburden was removed fom the open pit as waste. Mannix Co., Ltd., the mining contractor, has described the operation at Quatsino on the north end of Vancouver Island as a bright accomplishment. Pits and ropeway operated three shifts daily and the mill two shifts. The 52-ton trailer haulers carried to stockpile a daily average of 1,500 tons of concentrate, making 30 round trips each day over the 20-mile haul.

Cascade Lode Mines, Ltd., has entered into an agreement with Pacific Quarries, Ltd., of Vancouver, for the mining of magnetite ore at Zeballos, on the west coast of Vancouver Island. The agreement calls for payment of all development and production cost by Pacific Quarries with Cascade Lode receiving 25 cents per long ton of iron-ore shipments and 15% of all net smelter returns resulting from gold shipments.

Victoria.—Operating experience as reported by Cowichan Copper shows 894 tons of concentrate grading 27·66% Cu and containing 494,844 lb. copper to have been recovered from 7,372 tons of ore grading 3·5% copper during December. In January 918 tons of concentrate grading 27·47% Cu and containing 505,263 lb. copper was recovered from 7,045 tons grading 3·67% copper. All creditors were paid off on receipt of the final settlement for the first shipment of concentrate made in October, 1958. The second shipment was made on January 26 and contained 2,860 wet tons of concentrate with an estimated gross value of $400,000. The third shipment is scheduled for March 13 and will contain approximately 2,000 tons.

Nanaimo.—The annual report of Vananda Mines (1948) for the year ended November 30 last discloses settlement during the year of the debt of $50,000 to Sheep Creek Mines. Although the company's copper-gold property on Texada Island is being maintained in good standing it is the announced intention of directors to concentrate on participation in the development of the oil and gas industries in Alberta and Saskatchewan.

Skeena.—Owing to the requirements of the Toronto Stock Exchange Surf Inlet Consolidated Mines, Ltd., was unable to present its original proposal calling for reduction in the issued capital of 4,750,000 shares by a surrender of five shares in order to receive one share of a new company to be formed, at the annual meeting of shareholders on February 27. However, a resolution was approved whereby the surrender was altered to four shares for one, thus qualifying to meet the Exchange demands. An extraordinary meeting is to be called in the near future to approve an increase in capital to 3,000,000 shares and to select a name for the new company. The company holds a controlling interest in McVicar Mining Co., Ltd., whose copper property adjoins the Britannia mine on Howe Sound and where it is expected a definite development programme will be undertaken this year. No immediate work is plannned on the original Surf Inlet gold mine on Princess Royal Island.

Kamloops.—Patino of Canada, Ltd., through a Toronto brokerage house, has purchased 200,000 shares of Bethlehem Copper Corporation, Ltd., at a cost of $1·40 per share and has obtained options on a further 325,000 shares.

Lillooet.—Shareholders of both Bralorne Mines, Ltd., and Pioneer Gold Mines of B.C., Ltd., have approved the merger of the two companies, whose properties adjoin each other in the Bridge River Valley of British Columbia. The total recorded production of the two gold mines is valued in excess of $108,000,000. The joint operation will be conducted in future under the name of Bralorne Pioneer Mines, Ltd., which company has approximately $3,000,000 in working capital with a total share issue of only 1,597,350 shares after issuing 350,350 shares to purchsae all assets of the Pioneer company. The authorized capital is now set at 2,000,000 shares of no par value. Bralorne production is currently running at 9,500 oz. of gold monthly a figure greater than that obtained during peak operation at the outbreak of World War II. The new board of directors includes leaders in Canadian mining and makes provision for two appointments to be made by Pioneer Gold Mines. The new president of the company, Dr. Franc R. Joubin, has announced that Bralorne Pioneer will take an active part in the exploration field. Present interests include gold and base-metal properties in Manitoba and British Columbia and a substantial holding in a producing oil company. In British Columbia the company, through the former separate activities of the partners, holds an interest in the development of a mercury prospect in the Omineca district in partnership with Canex Aerial Exploration,

Ltd., and Noranda and a similar interest in a lead-zinc property near Revelstoke now under option to the Bunker Hill Exploration Co., of Kellogg, Idaho. In Manitoba, Bralorne Pioneer is engaged with Northern Canada Mines, Ltd., in the development of several blocks of claims in the Snow–Chisel Lakes area. The oil holdings are principally concentrated in New Chamberlain Petroleums, Ltd., which is currently delivering sweet gas to Trans Canada Pipe Lines, Ltd.

Greenwood.—The 58th annual meeting of Granby Consolidated Mining, Smelting, and Power Co., Ltd., approved a change in the name of the company to "The Granby Mining Co., Ltd.," an increase in capitalization to 2,000,000 shares with a par value of $5·00 each, and sweeping changes in powers granted under the company's charter. It was the first time the meeting had been held in British Columbia, a development which marks the passing of control from New York to Vancouver. Originally organized to bring the old Phoenix copper properties into production, the company has since operated big copper mines at Anyox and Copper Mountain and smelters at Grand Forks and Anyox. By coincidence, the president of the company, Mr. L. T. Postle, was able to announce at the meeting that a subsidiary (Phoenix Copper Co., Ltd.) would commence production at the original Phoenix property in the near future. The project has been in an advanced state for over a year, when the decision to defer production was made due to the declining price of copper at the time. The current reversal therefore reflects the much more optimistic viewpoint now obtaining. The company has recently made substantial investment in the development of western Canadian oil and gas properties.

Slocan.—Western Exploration Co., Ltd., plans to resume milling at its Silverton mines within three months, according to a statement by Hill, Starck, and Associates, the consulting engineers. A substantial reserve of good ore has been developed in the Mammoth mine, with approximate average grades of 10% lead, 5% zinc, and with some 10 oz. of silver to the ton. It is also proposed to extend one of the low levels to reach the Buffalo mine at depth and explore the persistence of formerly producing veins in the upper regions of the property. The company's 250-ton mill has been idle since December.

Lardeau. — Transcontinental Resources, Ltd., gained control of Sunshine Lardeau Mines, Ltd., at the annual meeting of shareholders held on February 27. An offer of 19 cents per share had been made to all shareholders, despite the inactivity of Sunshine Lardeau and the apparent value of 17 cents per share according to net current assets. The balance sheet at October 31, 1958, listed current assets at $566,949 against current liabilities of $4,128. Buildings, equipment, and other mining facilities, originally costing $860,313, were written down to $266,274. The company has authorized capital of 4,000,000 shares of no par value of which 3,280,000 shares are outstanding.

TORONTO

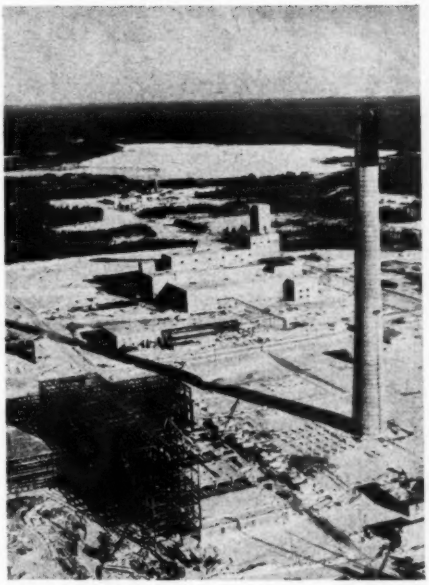
March 25.

Gold Production.—The output of the gold mines of Ontario for January included 227,981 oz. of gold and 32,976 oz. of silver, valued at $7,798,523, from 799,178 tons of ore milled.

Geological Maps.—Preliminary geological maps of the townships of Clergue, Dundonald, Mann, McCart, Newmarket, and Reaume have been prepared by the Ontario Department of Mines from assessment work reports and from company surface and drilling plans. The base maps for plotting are taken from the Forest Resources Inventory sheets, Ontario Department of Lands and Forests, and are on a scale of 1,320 ft. to the in. The geology was compiled by J. Satterly and S. A. Ferguson of the Department's staff. These townships are of particular interest because of the presence of a zone of peridotite sills and dykes.

Sudbury.—The net earnings of the International Nickel Co. of Canada, Ltd., and subsidiaries for 1958 were $39,665,000 in terms of U.S. currency, equal to $2·71 per common share; this compares with net earnings of $86,141,000, or $5·90 per share, in 1957. The drop in 1958 earnings, according to Dr. John F. Thompson and Mr. H. S. Wingate, reflects "the lower demand for nickel, sharply reduced prices and deliveries of platinum metals, lower prices for copper, and a strike against the company which stopped all production at the mines and plants

in Ontario during the final three months of the year." By year-end the strike had been settled and production at the mines and plants resumed. It is pointed out that, in sharp contrast with the experience of recent years, the demand for nickel in 1958 declined so severely in the United States, the principal market, that the company during the first half of the year was forced to make three successive curtailments in its rate of production in Canada. Indeed, 1958 was the first year in almost a decade, the chairman and the president say, in which International Nickel did not operate at capacity. "Nevertheless," they continue, "the company continued its new nickel mining project in northern Manitoba, development of which was ahead of schedule. The prompt completion of this project is of great importance to the company, since prospective users of nickel, who have experienced many years of nickel shortage, must be given assurance not only that supplies will be plentiful in the future, but that the industry's production capacity will be large enough to handle surges in demand." They say that by mid-February, 1959, there were definite indications of an upturn in nickel demand and the outlook for increased sales was more encouraging than at any time since the reversal of the supply-demand situation at the end of 1957. The accompanying photograph shows progress at the new project in northern Manitoba. In the left foreground is the steel work for the smelter. Between it and the 500-ft. stack are foundations for furnaces and convertors. Immediately beyond the smelter is the compressor building and then the mill, of which the mine production shaft headframe is an integral part. In the distance can be seen Thompson Lake.



Inco Progress in Manitoba.

Manitouwadge.—An interim report on the operations of Geco Mines in 1958 shows that 1,286,129 tons of ore was milled for an estimated net profit of $5,197,600. The report states that the Mining Corporation of Canada loan has been reduced by $2,400,000, leaving a balance owing of $9,600,000 (since reduced to $9,000,000). Development headings have been driven east of No. 1 shaft to approximately 335 ft. on the 850 level, 1,175 ft. on the 1,050 level, and 1,188 ft. on the 1,250 level. This work has confirmed ore previously indicated by diamond drilling on the 850 east and extended the ore since the last quarterly report by 150 ft. on the 1,050 level and 250 ft. on the 1,250 level. At the same time the exploration drive west on the 850 level was advanced to approximately 2,869 ft. west of No. 1 shaft, copper mineralization being fairly consistent for the last 300 ft., although no ore lengths were found. Preparations continue for sinking the internal No. 3 shaft from the 1,250 level.

Quebec.—The gold output from Quebec Mines for October last has been reported as 100,387 oz. and that of silver as 354,153 oz. For the 10 months to October 31 the totals were 872,384 oz. of gold and 3,300,445 oz. of silver. In October 93,513 tons of asbestos was shipped, making the 10-month total 712,323 tons. Figures for November are 88,907 oz. of gold, 329,439 oz. of silver, and 102,946 tons of asbestos.

Stadacona Mines, in the Noranda area, ceased mining and milling operations at the middle of December. Disappointing results were obtained in the A zone, which was regarded as the main hope for maintaining profitable operation, it is stated. The company plans to continue active in outside exploration.

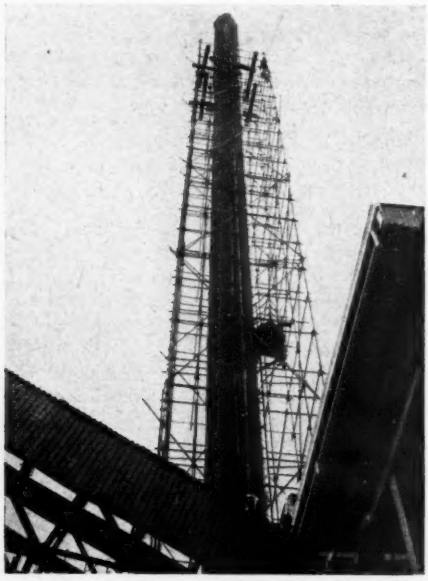
During 1958 the Quemont Mining Corporation treated 859,170 tons of ore for an estimated net profit of $1,860,700.

MELBOURNE

March 20.

Mount Morgan.—Mount Morgan, Ltd., is examining a project that will involve the use of large tonnages of the company's pyrite resources, which under present conditions are used to a limited extent only. The pyrite concentrate is produced as a by-product in the concentrating of the copper ore to smelting grade ; current production is large and the accumulated tonnage is larger still. The Sugarloaf ore-body, which is lower in gold and copper than the main ore-body, depends to a large extent on utilization of the pyrite content for its profitable working, but the demand by acid makers for sulphur from pyrite has been disappointing. This mineral cannot compete with imported brimstone for acid manufacture without assistance by way of sufficient bounty to encourage its use. It is hoped that some help will be given by the Government which will result in turning the large pyrite reserves to profitable account.

The project now being examined by Mount Morgan is for the establishment of an ammonium sulphate plant in Central Queensland using Mount Morgan pyrite. There is a difference of opinion as to the source of fuel—whether it will be Callide coal or coal from the company's Baralaba colliery. The second source is supported by the proposal to establish the works at Mount Morgan itself, as against a site at or near Rockhampton. The cost of the proposed enterprise is stated to be £A6,000,000 and there are suggestions that other industries might follow if the fertilizer works is established.



200-ft. Stack at Gold Mines of Kalgoorlie.

Sulphate of ammonia would be used largely on the cane fields along the Queensland coast, where the consumption approximates 80,000 tons per year, the total Australian requirements being about 120,000 tons per year. Other Australian fertilizer manufacturers and probably two overseas firms are interested in the proposal.

Mount Isa.—Mount Isa continues to expand rapidly as its schemes continue to develop. The latest output figures show the growing importance of copper in the mine's operations and that lead production is taking second place. The increase in copper has been stimulated by the improved price, substantially helped by the Commonwealth Government bounty of £A45 per ton on local sales to maintain a price of £A330 per ton to Australian producers. It is expected that the Mount Isa electrolytic copper refinery at Townsville will commence operations toward the end of this year ; the initial output will be 30,000 tons of blister copper annually, which will be increased to 60,000 tons.

A most important factor in the expansion scheme is the rehabilitation of the Townsville–Mount Isa railway, about which there has been delay, but it seems that details now remain to be finalized and that this important work will be commenced by the Queensland Government almost immediately.

Western Australia.—Gold production in Western Australia for January was 63,924 fine oz., which brings the total for the State since the first days of gold mining to 59,976,826 oz. The present rate of output is about 70,000 oz. per month. While the Kalgoorlie mines average an even rate of production, North Kalgurli (1912), Ltd., appears likely to continue its important progress. Diamond drilling results have been particularly interesting for some time. In the Kalgurli section, on No. 11 level, No. 1,419 drill-hole west from the north drive intersected 57 in. of lode assaying 120 dwt. gold per ton. On No. 18 level hole No. 1,425 bored west from the main crosscut section met high-grade ore in several sections.

One intersection assayed 32 dwt. over 48 in.; a second intersection gave a value of 16·8 dwt. over 12 in. and a third assayed 17·5 dwt. over a width of 24 in. Highest values were met in hole No. 1,432 west from the main haulage drive on the same level; one intersection here was worth 1,800 dwt. over 12 in. and a second 20 dwt. for 9 in.

Progress at the Great Western Consolidated at Bullfinch has been consistently disappointing since the commencement of production, but the company has done remarkably well to meet costs on the grade of ore mined. Development at the Copperhead mine has been pushed ahead vigorously and recent reports point to what may be an important change. The downward continuation of the Watershaft ore-body has been intersected in diamond drilling from No. 22 level of the northern series workings. One intersection gave assay values of 9·4 dwt. gold from 77 ft. to 110 ft.; a hole 60 ft. south of this bore passed through 90 in. of ore worth 17·3 dwt. and at 60 ft. further south values were 12·1 dwt. over 60 in. A fourth diamond-drill hole at 70 ft. further south assayed 5·5 dwt. from 60 ft. to 70 ft. and 2·4 dwt. from 77 ft. to 110 ft. These appear to be the best values met in the mine so far. The Watershaft ore-body has been worked by the company from No. 12 to No.18 level.

One of Great Western Consolidated's more recent acquisitions was the Nevoria mines at Marvel Loch. Development results have improved and the mine is now sending a good tonnage of ore by road to the mill at the Copperhead mine at Bullfinch. Present output is 7,000 tons of ore per month, against 4,000 tons several months ago. No. 2 shaft has been sunk to a depth of 655 ft. and on No. 2 level driving has disclosed ore assaying 6·4 dwt. gold per ton, while at No. 3 level the west drive was in ore averaging 9·4 dwt. per ton.

The only outstanding assay value at Central Norseman Gold Corporation in the last month was at No. 16 level on the Crown Reef, where ore worth 29 dwt. gold over 54 in. was reported. The lode at that distance has been displaced by a fault.

Northern Territory.—Australian Development's Noble's Nob mine, at Tennant Creek, continues to open up new reserves of good ore, laterly on leases adjoining the main leases. One of the most attractive of these adjoining leases has always been Weaber's Find, but following early somewhat disappointing prospecting exploration was not pushed ahead. Recent long-hole drilling has made some good intersections.

A neighbouring lease, the Archangel, has been examined but does not appear to have come up to expectations. Meantime, Noble's Nob has reserves for six years and exploration above the 300-ft. horizon continues to meet ore extraction.

Zinc Corporation.—The Consolidated Zinc Corporation has important work in hand in New South Wales, where the new zinc smelter at Cockle Creek, near Newcastle, will soon

Mount Morgan—The Open Pit.

emerge from the planning stage. The new smelter will be similar to that recently erected by the Imperial Smelting Corporation in England, with a sintering plant as an adjunct. It is planned to commence smelting operations about the middle of 1961 and the capacity of the works will be 40,000 tons of zinc per year. The additional production of roaster gases will permit increasing acid plant capacity and a greater output of superphosphate. The new smelter will treat part of the zinc and lead concentrates produced at Broken Hill which are at present sold out of Australia, supplementing production by the Risdon (Tasmania) works of Electrolytic Zinc Co., of Australasia and the lead smelters of the Broken Hill Associated Smelters at Port Pirie. Total cost of the Cockle Creek plant has been estimated at £A8,000,000. Capacity of the new plant is stated as 40,000 tons of slab zinc and a similar tonnage of lead bullion per year.

Uranium.—Mary Kathleen Uranium, in North Queensland, is ahead of schedule in production for its £A40,000,000 contract with the United Kingdom Atomic Energy Authority. The cost of the project is £A13,000,000 and production and efficiency have been higher than was anticipated. The open-cut is now working five benches and is very nearly meeting all mill requirements, although some ore still being drawn from stockpile. From the commencement of milling on June 30 to December 31, 1958, the profit was £A1,417,266 from the output of uranium oxide valued at £A2,566,818. Ore treated in the seven months was 226,000 short tons assaying 3·07 lb. uranium oxide and recovery was 562,000 lb. uranium oxide, overall recovery being 86·3% on head values. There has been some anxiety about water supply for the intake into the dam is limited to the wet season, the incidence of which can be variable. Good rains have relieved the situation and the dam is now two-thirds full, assuring water supply for a considerable time. It is stated that uranium oxide production to the value of £A5,000,000 per year can be expected.

The search for uranium by companies as well as individual prospectors has declined markedly and in the past year to June 30 only four discoveries of radioactive mineral were reported; these were not of an important character. It has been pointed out that world supplies may be short in 10 years' time unless stimulated prospecting expands the number of potential producers or increases reserves. Radium Hill, in South Australia, is reported to have the biggest ore-body yet found in South Australia and apparently the only occurrence of commercial importance. Queensland has the large Mary Kathleen occurrence, which is an open-cut proposition, but although numerous occurrences were located in the boom days no other has been of commercial value. Northern Territory has three deposits of productive importance, but Rum Jungle has worked out its major ore-bodies.

Steel.—The Commonwealth Government has stated that Australia must increase steel production considerably in the next few years. This position is fully realized by the steel-producing company Broken Hill Proprietary and its subsidiary Australian Iron and Steel. Broken Hill Proprietary plans to spend £A100,000,000 on expansion by 1961, but it is thought that this expansion may not be sufficient to supply the steel needed by the country in which the demand has almost trebled in the last 20 years. It is expected that domestic requirements would grow at the rate of 100,000 tons per year in the 1960's.

Search for new deposits is very important, for existing deposits of iron ore could be exhausted in probably 100 years. There are lower-grade ore occurrences which will no doubt enter into the field and the very extensive taconite occurrences in the middle-back Ranges of South Australia are being examined by Broken Hill Proprietary. Considerable research and pilot-plant work on the treatment of the taconites has already been done by the company. A report by the Industries Division of the Trade Department stresses the fact that no reason exists for assuming that the demand for steel which has almost trebled in the last 20 years should not double at least within the next generation.

It would seem in the National interest for the Broken Hill Proprietary Co. to be given every encouragement in the avoidance of delays in its development programmes. The scarcity of steel has proved a heavy drain on Australia's overseas funds. Demand for payment for imports in some recent years has amounted to £60,000,000 per year, which has limited Australian development. Little advantage could be taken of the large markets which existed in the post-war years. Steel imports in the six years since 1949–50 have averaged 600,000 tons per year. The Broken Hill Proprietary group had under lease the most accessible high-grade iron ore

deposits in Australia and the plans for expansion, if fulfilled, give it an ingot capacity of 3,600,000 tons by 1961–62. Within the next decade Australia could need an export steel industry about 1,000,000 tons greater than the present expansion plans visualize. This estimate assumed that 10% to 25% of the steel Australia produced would be exported.

Australian raw steel is described in the report as amongst the cheapest in the world, the current average price of British and American steel landed in Australia being about £20 per ton above domestic price. Any newcomer into the steel industry would be faced by the difficulty of getting adequate and suitable ore supplies outside the leases held by the Broken Hill Proprietary Co.

Brown Coal.—The three open cuts of the Victorian Electricity Commission—Yallourn, Yallourn North, and Morwell—produced 10,000,000 tons during 1958. Of this, 7,700,000 tons came from the main Yallourn open-cut. During the year a new dredger with a capacity of 1,350 tons of brown coal per hour has been placed in the cut and a new dredger is under construction which will dig 1,750 tons of brown coal per hour.

FEDERATION OF MALAYA

March 10.

Tin Industry.—The decision to raise the six producing countries' export quota under the International Agreement by 3,000 tons to 23,000 tons for the second quarter of 1959 has been hailed in Malayan tin circles as the first " heartening " news since the agreement was enforced at the end of 1957. Certainly, so far as Malaya is concerned, the extra quota means increased production and more jobs. Mr. Woo Ka Lim, a representative on the Federal Legislative Council of the Chinese section of the industry, said, when welcoming the news, that this would probably mean the turning point in the present situation. Some Chinese mines will no doubt be able to operate again and thus relieve present unemployment. The International Tin Council has also announced that all the tin bought with money in its " special fund " has now been sold. The quantity of tin in the special fund had not been disclosed but was estimated at 5,000 tons. According to market reports the world tin position should show an overall improving position throughout this year and the Buffer Stock supply may be needed to meet consumers' demands.

Mr. J. T. Chappel, chairman of Petaling Tin, Ltd., told the annual meeting of that company in Ipoh that the events of the past year had shown " a serious weakness " in the operation of the International Tin Agreement in that non-participating countries such as Russia and China had been in a position to sell unlimited quantities of the metal at prices only maintained by drastic curtailment of exports by the six signatory producing countries. He considered that Malayan producers could not be expected to continue indefinitely the current heavy restrictions on their sales of tin ore in order to maintain a tin price at which non-participating producing countries could sell any quantities available in excess of their own requirements of the metal. He suggested that, while it was impossible to estimate the amount of the total production of the Sino-Soviet bloc surplus to their internal consumption, recent events had indicated that it is substantial and the future of the International Tin Agreement would depend on whether satisfactory and reliable arrangements could be established and maintained for the control of exports from the bloc.

Thailand has agreed, it is reported, to exchange 2,250 tons of tin with the United States for the latter's tobacco. Mr. Setthabut, Thailand's Director-General for Mines, is quoted as saying that the International Tin Council had agreed to let the barter deal go through outside Thailand's normal tin quota. A mining source in Kuala Lumpur is reported as saying that a number of mines and individuals in Malaya had been approached on this subject by an international firm specializing in barter deals.

Oil Terminal.—A new oil terminal costing about £120,000 has been opened at Tanjong Kling, Malacca, by the Standard Vacuum Oil Company. A hill has been levelled at the terminal site for construction of six storage tanks with a total capacity of about 2,000,000 gallons. A pipeline runs for one mile to the beach and for another half-mile under the sea to a tanker mooring point. This is Malaya's longest submarine pipeline.

Mr. J. T. Beard, the company's Malayan manager, said that another terminal was now being built at Kuantan on the east coast and would be operating a few months hence. New terminals would also be completed this year at Kuala Trengganu and Kota Bharu, which are also on the east coast.

Iron Project.—Executives of the Eastern Mining and Metals Co., Ltd., Malaya's biggest iron-mining concern, have arranged for iron and steel industry leaders in Japan to buy the ore from a (Malayan) $50,000,000 iron mine to be opened up in Pahang. Mr. J. N. McHugh, director in charge of the new project, which is expected to begin production in 1963, said that the Japanese had undertaken to buy not less than 1,500,000 tons of ore a year from the new mine, increasing if necessary to 2,500,000 tons annually. They had said that in view of the expansion of Japan's steel industry the new development was a matter of urgency. An approach is planned to the U.S.A. for money from the American Development Loan Fund to help finance the project.

An announcement said that the construction of roads and bridges by the Malayan Government would bring greater opportunities and stability to rural areas in the Federation, help farmers to market their crops, and encourage the exploitation of mineral resources on the east coast.

North Borneo.—The Japanese Federation of Economic Organizations has agreed to send a team of experts to British North Borneo to explore the possibility of developing natural resources there with Japanese capital.

Investigations have also been made into the possibility of mining chromite on a commercial scale in North Borneo, says a message from Jesselton. Routine mapping by the Geological Survey office has proved that there are in North Borneo some 700 sq. miles of ultrabasic rocks that may contain commercial concentrations of chromite and the panning of sand from stream beds in those areas has shown that the mineral is commonly present.

Indonesia.—The Indonesian Government has introduced a Bill to revoke mining rights given by the Dutch Government which are not now being exploited. The Bill is expected mainly to affect mining licences held by Dutch persons.

Export Control in India.—The Indian Government has made a comprehensive review of the Export Control Order and the rules and regulations under it with a view to enlarging the scope for exports. Consequently more than 200 items have been freed from control. These include: Manufactures of iron and steel, aluminium, brass, copper and lead, aluminium sheets and plates, cast-iron pipes, steel pipes, brass sheets, tin containers, antimony ores, and nickel and tin ores.

JOHANNESBURG

March 26.

Union Budget.—As in the two previous budgets the gold-mining industry was again remembered in the 1959 statement of fiscal policy and in a way that should encourage the continuation of operations to greater depth by some of the older mines and the extension to or initiation of operations at ultra-deep levels by new mines. In his Budget address the Minister of Finance extended the provision for the addition of 5% interest per annum to capital expenditure unredeemed at the appropriate time which can be set against taxable profits for the purposes of taxation from new ultra ventures to all mines which planned the extension of operation beyond 7,500 ft. below surface. In addition to Western Deep Levels this benefit will affect East Rand Proprietary and possibly one or two other mines of the old Rand—viz. City Deep; the West Wits. line from Venterspost to Doornfontein; the Klerksdorp field, especially Zandpan, Buffelsfontein, and the extension south of the Vaal River and possibly many of the other new mines in the area; as well as sections of the Free State field, including the unexploited area south of the St. Helena–President Brand–President Steyn block. It is not yet known whether the concession will be applicable to those operations—such as, the sinking of a vertical shaft preliminary to the sinking of a subvertical component—which would be necessary at depths shallower than 7,500 ft. in order to facilitate eventual extension below that depth. The depth of 7,500–8,000 ft. has come to be accepted as the start of ultra-deep operations. The details of the extended concession will become available only when the Finance Act is formulated, which may empower the Receiver of Revenue with discretionary authority.

Uranium.—The security provisions controlling the release of data on the uranium project have been relaxed further. Previously confined to the publication of the net working profit before taxation, the recovery and, in the final 1958 quarter, of the weight sold, the companies may now also disclose revenue from sales of uranium oxide. For the term of the existing contract between the uranium producers through the S.A. Atomic Energy Board, the aggregate sales quota has been fixed at a ceiling of 6,200 short tons a year, which the combined Development Agency

(representing United States and British official buyers) are prepared to accept from South Africa. All the individual contracts will have expired by the end of 1966 or shortly thereafter and provide a purchase price related to the cost of production at each mine. The price formula covers working costs in the extraction plants and excludes costs of mining, covers also repayment of the uranium project loans *plus* interest, and profit, with a bonus incentive related to reductions in working costs. Details of the individual contracts remain prescribed.

Over 1958 a total of 12,491,337 lb. of U_3O_8 was produced and exports were valued at £52,612,263 which, on the assumption that total output was realized, was equivalent to £4·212 per lb., of which it can be roughly estimated £3·021 represented working profit before tax and other appropriations. The average extraction costs therefore roughly amounted to 23·82s. a lb. These figures must of course be projected against the terms of the contracts. Excluding costs of extraction in the uranium plants average costs debited against the gold accounts were 55·17s. a ton milled or 118·6s. a lb. of U_3O_8. Without the cost-plus formula and accumulated residues and gold revenue, therefore, the uranium project would have been uneconomic for the mines. At a selling price of £3 per lb. the uranium producers would have been allowed only about 26s. a lb. for mining costs on the basis of 1958 returns. Gold production, however, even from the low-grade gold content of some of the producers would recover much of that figure (26s. a lb.). Nevertheless, some would be squeezed out of the project at a selling price of £3 lb.

Balance of Trade.—In January this year the deficit in the balance of trade was reduced to £13,158,000 from the 1958 level of £25,002,000 and from the 1958 monthly average of £14,288,000. In January, 1959, imports were valued at £43,056,000, exports at £29,897,000, and sales of gold bullion at £19,255,000 respectively, compared with the corresponding total 1958 figures of £555,973,000, £384,517,000, and £221,869,000.

With the total 1958 figures in brackets, individual January, 1959, exports included mining machinery, £259,000 (£4,499,000); chromite, £173,000 (£2,972,000); lead concentrates (re-exports), £34,000 (£6,438,000); manganese ore, £336,000 (£5,061,000); fire-refined and blister copper, £433,000 (£6,432,000); asbestos, £725,000 (£10,416,000); coal, £72,000 (£1,663,000); diamonds, £5,331,000 (£30,683,000); radio-active minerals, £4,810,000 (£53,207,000); bunker coal and ships' stores, £526,000 (£7,743,000).

Railways.—In his recent Railways Budget the Minister of Transport stated that almost 6% more traffic is being carried than in 1957–58 and about 14% more than in 1955 when the accelerated development programme was initiated. With only one exception (non-mining) all traffic now offering can be carried. While under present conditions new traffic—especially high-rated, including imports—has not been evident to the extent expected, the capital works programme is being persisted with in order to keep pace with the country's economic development. An important factor in the present carrying capacity has been higher efficiency in the organization. Coal traffic has risen further: the total tonnage of base-minerals traffic improved and while the chromite tonnage declined in both the internal and export sectors increased domestic sales of manganese ore more than offset declines in export.

On the subject of a link-up of the Eastern Transvaal system with Swaziland and the Sordwana Bay project on the North Natal Coast the Minister commented as follows: Recently negotiations were again conducted with the Swaziland Administration to build a line through that territory to a new harbour which would be equipped on the East Coast. It was considered that the line would be needed for Swaziland exports of wood products, coal, and iron ore and for an estimated coal export tonnage from South Africa through the proposed new harbour of about 5,000,000 tons of coal a year. The estimated expenditure was £35,000,000 to £40,000,000. The more recent change in economic conditions overseas has rendered such an outlay unjustified and accordingly the whole project has been abandoned. Modified schemes to assist Swaziland in its possible exports are still being considered.

Diamonds.—South African diamond interests, including De Beers Consolidated, in association with Engelhard Industries, have established in Canada a research company—Consolidated Diamond Development Co., Ltd.—which will have as its main object the expansion and development of natural diamond abrasives, embracing all

aspects of diamond abrasive usage. Engelhard Industries and De Beers and its associates will each contribute 50% of the initial capital of $300,000.

Feralloys, Ltd.—Feralloys, Ltd., of the Anglo-Transvaal group, has nearly completed the installation of the first two furnaces for the production of ferro-manganese at its Cato Ridge works in a programme that will eventually see eight furnaces installed. Each of the first two furnaces will have an output capacity of 60 tons of high-carbon ferro-manganese a day and should be completed by about the mid-year. Final decisions on the erection of plant to produce pig-iron have yet to be made.

Soda Ash.—Federale Mynbou Beperk is planning the erection of a £2,000,000 plant at Sasolburg in the Northern Free State, in the vicinity of the oil-from-coal project, for the production of soda ash at the rate of 120,000 tons to 150,000 tons a year. Salt would be supplied from Port Elizabeth, lime from the Southern Transvaal area, and carbon dioxide gas from the oil-from-coal project.

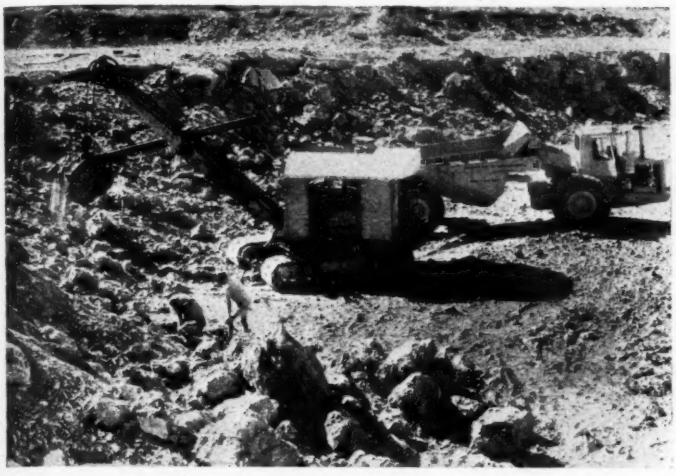
Oil from Coal.—There seems little doubt but that, if the existing oil-from-coal project in the Northern Free State proves satisfactorily successful, other similar plants will be erected. In January this year the oil-from-coal project reversed previous losses and it should earn a profit this year. The plant has a scheduled output capacity of 39,000,000 gal. of petrol a year and 21,000,000 gal. of other products. Existing funds are considered adequate for the rounding off of this production schedule, which is expected to facilitate the writing off of about £2,000,000 a year.

Oil.—It has been reported that prospecting for oil in an extensive area of the northern zone of the territory is expected to be initiated in the near future. This zone, contiguous with the border with Angola, where oil has already been discovered and production is under way, may have southern extensions of the Angola field.

Transvaal.—The Unified Gold and Exploration Co., Ltd., which has already entered into an agreement with the Anglo American group in respect of 43,200 claims in the Ventersdorp–Coligny area of the Western Transvaal, north of Potchefstroom, now proposes an increase in the share capital to provide for the acquisition of options rights over 72,000 claims in the Ventersdorp–Klerksdorp–Lichtenburg area of the Western Transvaal; an agreement with Rand London Corporation, Ltd., in respect of options over about 43,200 claims in the Dalmas area of Eastern Transvaal and over about 2,600 claims on the farm Hakkies in the Ventersburg area of the Free State.

Orange Free State.—Loraine Gold Mines, the lease area of which was increased to 7,585 claims by the acquisition of Riebeeck, is obviously not yet in a position to indicate the proportion of ore that will be drawn for milling from the Loraine or Riebeeck sections. However, mining policy is now being directed to the reduction of the scale of operations in the Loraine section and the confinement of these to payable or possibly payable zones in the southern section in the No. 2 shaft area. Basal Reef development will apparently be concentrated mainly south and more particularly to the west of that shaft and B Reef development mainly south-westwards from that shaft. Proportionately greater effort will be diverted to opening up the multi-banded Elsburg Reefs in the extreme south-western section, in the northern Riebeeck section, and after completion of the No. 3 shaft in the central Riebeeck section about the mid-year from that shaft. In the meantime cross-cuts eastwards are being driven from the twin-haulage advanced from No. 2 shaft into the Riebeeck section in the foot-wall of the main body of the multi-banded Elsburg Reefs but above the lowest reef of the series. In the south-western section from No. 2 shaft the reef dip steepens considerably in the extensive eastern leg of a syncline, the western leg of which is much shorter and folded up almost into the vertical plane. The multi-banded Elsburg Reefs are in a smaller syncline above the western leg of the major syncline. The steep dip of the formations west and south-west of No. 2 shaft necessitated opening up the ore-bodies from level haulages driven on the incline in order to obtain a long enough face on dip. The twin-haulage from No. 2 shaft, advanced into the Riebeeck section, was an extension of one of these incline level haulages, 48, until the horizon of the multi-banded reefs was reached, whence it was driven on the horizontal. No. 52 level sunk on the incline to the same horizontal plane is being extended on the same plane to connect with the horizontal 48 haulage and so form a return circuit with No. 2 shaft.

The lateral extent of the multi-banded syncline is not known and may be more or less



Mining Vermiculite in the Transvaal.

than 1,000 ft. The maximum bore-hole lateral extent indicated was about 1,300 ft. over a strike of the order of about 25,000 ft. The multi-banded horizon should result in a tonnage per unit of area higher than the normal average.

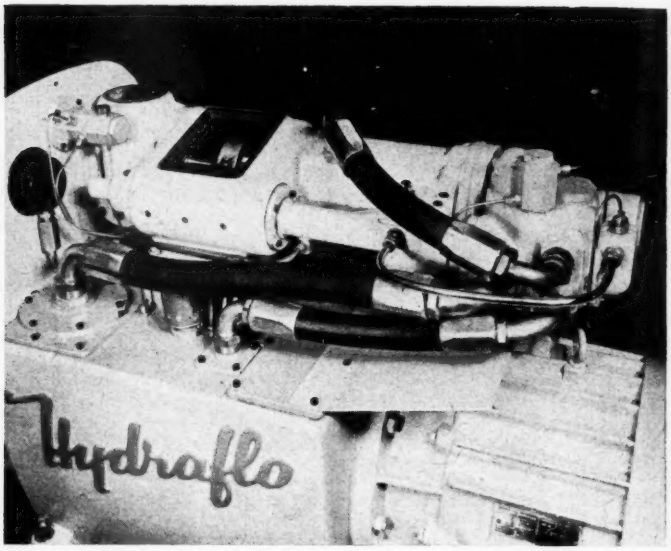
Trade Notes

Brief descriptions of developments of interest to the mining engineer

High-Pressure Water Pump

For the suppression of dust in coal mining deep-hole infusion is now widely practised and to supply the required water the tendency has been towards higher pressures and rates of flow. To meet this requirement **Tangyes, Ltd.,** of Smethwick, Birmingham, have designed the "Hydraflo" pump, illustrated here, which is capable of outputs of 1,000 gal. per hour at 1,500 lb. per sq. in. pressure or 500 gal. at 3,000 lb. per sq. in. The principle of the Hydraflo is simple. Oil hydraulic power is used to reciprocate the plunger instead of the conventional system of gears, crank-shafts, and connecting rods. In applying the principle the drive is "in line" and consequently, it is claimed, there are no heavy pressures on bearings and no high torques which are associated with the design of crank-driven pumps. A large-diameter piston is used working at slow speed and requiring fewer cycles per unit of volume pumped. This results in a considerable reduction in the rate of wear on seals and valves. The piston speed of the pump is of constant velocity over a complete cycle, giving almost straight-line continuous output.

The initial motive power is provided by a normal 1,450-r.p.m. induction motor direct coupled through a flexible coupling to a high-speed oil pump. Oil is drawn from the tank through a suction strainer and delivered to a sequence valve, which controls the flow of oil to the driving cylinder. The oil piston assembly reciprocates and, as it is integral with the water cylinder, pumping is achieved. Reversal of the stroke is brought about by a mechanically operated trip mechanism which operates the sequence valve. The trip mechanism ensures self-starting under all conditions and its action is controlled by



Tangyes Hydraflo Pump

dampers which gives a smooth quiet change-over. Being continuously fed with oil the dampers need no attention. The trip mechanism is operated by tappets, actuated by sleeves, mounted in the banjo attached to the end of the oil piston rod and reciprocating with it. Compactness of the reciprocating unit is achieved by positioning the water cylinder unit inside the oil cylinder, with provision for the positive separation of the oil from the water.

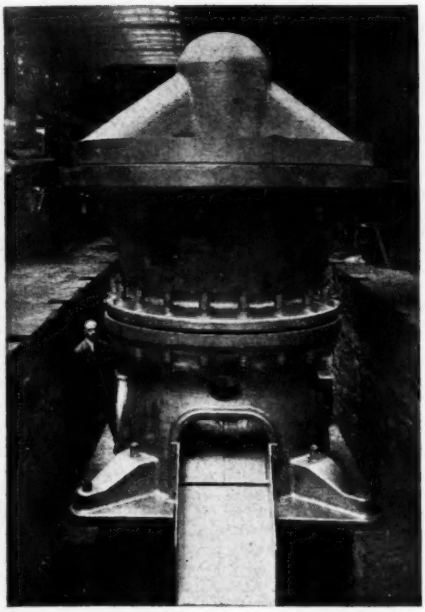
Overload protection is provided by an automatic pressure unloader valve which permits oil to flow freely back into the tank from the oil pump with little resistance. It is brought into operation when loading exceeds a marginal allowance over normal duty and so prevents the pump from continuously blowing through a relief valve when overloaded. It is designed to allow the pump to idle, taking little power and automatically to re-start the pump when the pressure is reduced. Should the pump be left unloaded for long periods a thermal unit reduces any heat generation to a safe level and guards against possible overheating due to abnormal conditions.

The makers point out that many other applications for the pump are envisaged than that for which it has been specifically designed and mention that development in the immediate future has higher pressures and quantities in mind.

Gyratory Crusher

A crusher which has found a wide field of application abroad—the "Babbitless"—is now being manufactured and marketed in this country by the **Babbitless Co. (Great Britain), Ltd.,** of 123, Victoria Street, London, S.W. 1. As the name implies, this type of machine does not use anti-friction metal for its bearings, the complete mechanism relying on roller bearings throughout. As a result the mechanism is said to consume little lubricant, only a small addition of grease being necessary every three months. High rotational speeds are possible and this, together with a small degree of eccentricity, is claimed to result in high capacity for any given size of machine as well as a more satisfactory cubical product. Indeed all unnecessary friction is reported to have been suppressed and as a result no cooling system for the lubricant is necessary, thus simplifying considerably the installation of the plant. The horsepower per ton of material produced is stated to be relatively small and the saving on power costs considerable.

The mechanism of the Babbitless crusher is claimed to be dust- and waterproof and it has been designed to withstand the arduous operating conditions encountered in the mineral extractive industries. Such crushers are manufactured in two types—primary, secondary or fine—and a wide range of sizes



Babbitless BP 38 Crusher

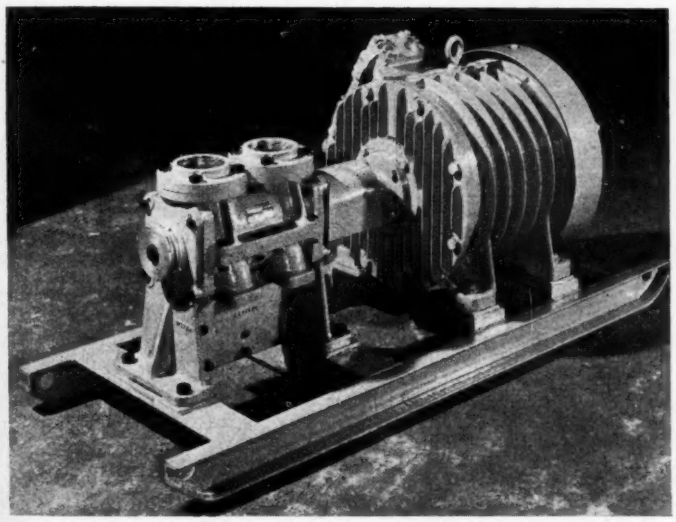
in these types is available to meet various requirements as to capacity or product size.

Tabulated information is available from the makers showing a wide range of crushers available in the primary range from the BP3 with openings of $2\frac{3}{4}$ in. by 14 in. to 84 in. by 252 in. for the BP84. The accompanying illustration shows the BP38 which, with openings of 38 in. by 138 in., can reduce 440 tons to 880 tons (depending on the rock type) per hour to 4 in. The secondary or fine crushers comprise a series from the BS502 with openings of 2 in. by 12 in. to the BS515 with openings of $14\frac{1}{8}$ in. by 57 in.

For wet and sticky materials the company manufactures a "Double Slugger Roll," which it is hoped to describe in a future issue of the MAGAZINE.

Axial-Flow Pumps for Mining

In the February, 1958, issue appeared a description of the Goodyear pump, which is of the axial-flow type. The pump is made by **Goodyear Pumps, Ltd.,** of 44, Brook Street, London, W. 1, which is a subsidiary company of **Holman Bros., Ltd.,** of Camborne. A version of this designed for mining service is now available as illustrated here. It is specially intended for face-drainage purposes where abrasive and often corrosive water has to be speedily and effectively removed. The unit comprises a Goodyear A12 positive-displacement pump which is direct coupled to a 1,440-r.p.m. English Electric $7\frac{1}{2}$-h.p. totally-enclosed fan-cooled flameproof motor mounted on a skid base. The pump delivers a constant 75 gallons of water per minute when running at this speed with a head of up to 200 ft. and with a suction lift of up to 28 ft. and is driven



Goodyear Mining Pumps.

through a flexible coupling from the electric motor shaft. It is offered in Meehanite or bronze with a stainless-steel shaft and can be fitted with a relief valve set at 87 p.s.i. The weight of the complete set is approximately 625 lb.

Personal

R. T. BRANDT has left for N. Rhodesia.

J. J. COLLINS has left for the United States.

D. J. FARQUHARSON has resigned from the board of West Vlakfontein Gold Mining.

J. GLEGG is now in South-West Africa.

H. C. GUNNING has assumed duty as consulting geologist (Rhodesia) in the Salisbury office of the Anglo American Corporation of South Africa, Ltd., in succession to Dr. T. D. GUERNSEY, who has retired.

T. T. HEYWOOD is returning from Sarawak.

L. B. PFEIL has been awarded the Institute of Metals (Platinum) Medal

D. W. PRINGLE is returning from Chile.

A. R. PUTNAM has been appointed managing director of the American Society for Metals.

J. B. RICHARDSON is returning shortly from Australia.

S. H. SHAW has been appointed Geological Adviser and Director of Overseas Geological Surveys with effect from July 1, in succession to Dr. F. DIXEY, who is to retire from the Public Service on June 30.

E. R. TONKYN is now in Uganda.

J. F. TURNER is now in Portugal.

J. A. LEVETT GALLARD, who died on March 14, was formerly well known in the City as a mining journalist, serving on both the *Financial Times* and the *Daily Mail*. The author of "Mines and the Speculative Investor," which appeared in 1924, he was for a short time on the staff of the MAGAZINE.

Sir JAMES DOUGLAS RAMSAY, Bt., died on March 14, aged 80. Educated at Trinity College, Cambridge, he was for a time at the Royal School of Mines, which he left in 1901 to go to South Africa. Except for a short engagement in Canada, Sir James worked on the Rand until 1914, when he joined the Forces, serving with the Scottish Horse. From 1919–1926 he was H.M. Commissioner on the Balmoral Estates, after that date taking up consulting practice as a Chartered Surveyor. Sir James was made M.V.O. in 1925.

GEORGE VERNON HOBSON, who died on March 16, was at the Royal School of Mines from 1911 to 1914 and from 1919 to 1920, following service with the Forces in the 1914–1918 war. In 1920 Dr. Hobson worked in Chile with the Braden Copper Company, but the following year he joined the Geological Survey of India, rising to Assistant Director in 1933. In that year he joined the Burma Corporation as geologist, transferring in 1935 to Mawchi Mines, Ltd. He was on the Gold Coast in 1939 with Gold Coast Banket Areas, resigning later in that year to rejoin the Forces, from which he was released in 1941 to work with the directorate of Open-Cast Coal. In recent years Dr. Hobson, who was made O.B.E. in 1951, had been in consulting practice. He was a Member of the Institution of Mining and Metallurgy.

Metal Markets

During March[1]

Copper.—From time to time day-to-day copper price movements in March have been a bit of a headache,[2] but, taking a broad view, there is no difficulty in seeing that the tone is firm. It is also not difficult to show that the greater part of this firmness springs from continued fears of a strike at American producing centres when the current three-year contract runs out on June 30. Anyone who could predict what would happen in the event, of course, would take appropriate action to sell a large quantity of copper long or short, rather than broadcast his opinion to others. For what it is worth, however, it may be noted that experienced market observers think along the following lines:

At present and without any subsidiary strikes or other interruptions to production world output is running at a higher level than consumption. There is therefore some leeway for consumers to build up stocks against the possibility of an American strike and this is what they are now doing, especially in America. The question hinges on the amount of metal the consumers are able to accumulate. Rightly or wrongly, the unions are credited with more intelligence than to start a strike in the face of heavy accumulations by the consumers, as, of course, the effects of the strike will then be minimized. At this early stage the consensus of opinion is that consumers may not be able to build up more than two or three weeks' supplies and that there will be a short strike.

In the U.S.A. actual consumption is still some way from the best but shows a tendency to recover from the worst levels of last year. The U.K., on the other hand, looks less active than it did a year ago. To a large extent this is attributable to the decline which has taken place in the volume of orders from Russia for copper wire, as has been noted, but the lack of resilience in other sectors of the industry at a generally more hopeful-looking time is not a good sign.

Undoubtedly one of the things which has helped to foster the stronger tone in the U.S.A. has been the very considerable volume of trade on the Commodity Exchange. Presumed to be largely of a speculative nature, this trading has accounted for over 200,000 tons in March for forward positions as much as 12 months ahead. Also bearing on the American picture is the fact that the custom smelters there have not been able to buy all the scrap they would like, although attempts to raise the price of custom-smelter copper to give a wider margin were not long-lived.

U.K. January copper consumption was 54,395 tons, less than in the same month of 1958; the proportion of refined copper, too, has gone down. Production of primary refined copper was 6,463 tons and of secondary refined 9,047 tons. Stocks of both blister and refined copper registered small advances to 15,114 tons and 50,827 tons respectively.

Tin.—There has been no change in the basic tin situation in March, so that it is at first a little surprising to note that right at the end of the month

[1] Recent Prices, pp. 200, 240.

[2] See Table, p. 240.

the market was able to exhibit so little confidence in tin as to let prices [1] slip back to the low 'seventies for a short period. It is true that psychological and technical factors entered into this to a certain extent, but probably the main factor in the mind of dealers in London is that it is now fairly well established that the Buffer Stock manager has been prepared to make sales from the stock at very little over his permitted level of £780 per ton—and has, in fact, made such sales. With the bulk of Buffer Stock holdings and activity centred on London, it is not surprising that this market should be most sensitive to actual or supposed sales of Buffer Stock metal, but the fact remains that prices ruling in Singapore and New York make London look quite cheap—even at £780.

Most people are now coming round to the opinion that sales of Buffer Stock metal at only a little above £780 per ton are part of a deliberate policy to acquire a little cash as soon as can conveniently be done. Apart from reducing the burden of financing the metal held by the Stock and providing cash for future flexibility the reduction in stocks would, of course, also have the desirable effect of proportionately reducing the depressing effect that the knowledge of the existence of these stocks exerts on the market.

U.K. January consumption of tin was 1,769 tons. Production was 2,355 tons and stocks were well down to 16,744 tons.

Lead.—Lead has been dull for some time past and, if anything, this has intensified in March.[1] Basic market factors are well known and not encouraging—especially outside the U.S.A. The only possible source of new developments on the horizon is the forthcoming meeting under United Nations auspices to discuss possible methods of achieving price stability for lead and zinc. As there seem to have been no changes of heart on any side since the last meeting signally failed to achieve any progress in this direction, this is not really an important factor.

Consumption of lead in the U.K. in January this year was 28,872 tons, rather less than in the corresponding month of 1958. Production was 6,286 tons and stocks rose to 48,102 tons.

Zinc.—Zinc continues to maintain quite a sizeable premium over lead in London,[1] in contrast to the U.S.A., where a recent decline in the lead market has brought both metals to the 11 cents per lb. level. The reasons for this are rather complex but have little to do with the U.S. import quotas. Basically the statistical position of lead is not all that much worse than that of zinc. However, the the zinc surplus is more marked in the high grades rather than in the g.o.b. dealt in on the London market. Also many zinc smelters in Europe have contracts based on the London prices, under which their concentrate supplies cut off at £70 per ton, so that for the sake of continuity of operations they have a strong incentive to resist selling at less than £70.

U.K. January consumption was 27,489 tons, the same as a year before. Production was 5,397 tons and stocks advanced to 37,733 tons.

Iron and Steel.—A hint of brighter conditions ahead has been given by the promise of the steel industry not to reduce scrap stocks further and to maintain purchases, as far as possible, at a rate commensurate with consumption. Exports of scrap, apart from a few inferior grades, have now been suspended. The steel industry, in fact, is prepared to buy scrap at a time when it cannot use it and as this would not be an attractive proposition for very long it can be inferred that the steel industry believes there will be a recovery in operations within a fairly short time.

At the moment, however, raw steel production jogs along at around 75% of capacity and apart from the call for sheets and some other light products demand is none too strong. Works producing heavy steel are in some cases only working around 60% of capacity.

As yet the steelworks cannot gain on the export market what they have lost in the home trade. Iron and steel exports continue to decline, falling to a little over 420,300 tons in the first two months of this year from 466,165 tons in the corresponding period of 1958. Imports remain at a low level and although there was a rise in February—mostly accounted for by bigger sheet arrivals—the total for the first two months of 1959 was 56,394 tons, against 173,732 tons in January–February last year.

Iron Ore.—Imports of iron ore into the U.K. continue to decline. In February they fell to 878,563 tons, making for the first two months 1,894,899 tons (2,296,813 tons in the same period of 1958).

Aluminium.—From a market observer's point of view there has been no alteration in the U.K. or world aluminium market during the past four weeks. As was mentioned in the previous report the one interesting facet of the aluminium industry at the moment is the secondary metal side. While primary metal continues in good supply scrap aluminium is still in short supply and bidding for supplies between ingot makers has already pushed prices up to the limit to which some people are prepared to go. At one end of the scale is the competition from other materials for the markets normally served by aluminium castings; at the other end is the shortage of scrap, which is pushing prices up and thereby threatening the supremacy of this metal in the casting field. It now remains to be seen whose margins will eventually suffer in this struggle, the scrap merchants' or the secondary ingot makers'.

Output of primary aluminium in the United Kingdom during 1958 totalled 26,354 tons, as compared with almost 30,000 tons in the previous year. Imports, however, were up on the 1957 total, being 210,433 tons compared with 179,692 tons.

The price in the U.K. remains at £180 a ton delivered.

Antimony.—There has been an alteration in the price of Russian 99·8% metal and this grade is now quoted at £144–£148 a ton. Other than this there have been no alterations and the market remains quiet.

English regulus is still quoted at £197 10s. a ton.

Arsenic.—March proved no exception to previous months and this market remained quiet and uneventful with the usual amount of business passing. Trioxide imports during February totalled 95 tons, a fall of almost 90 tons from the previous month's figure of 183 tons.

Bismuth.—Yet once again it is necessary to report that this market provided nothing of interest during the month and still remains quoted at 16s. per lb.

U.K. imports during February amounted to 90,418 lb., a fall from the January total of 109,017 lb.

Cobalt.—The outlook for this metal is still not too good and the February price reduction does not so far appear to have stimulated interest on the part

[1] See Table, p. 240.

of consumers to any great extent. Imports in February rose a little on the previous month's figures —193,901 lb., as compared with 105,512 lb. The U.K. price remains at 14s. per lb.

Cadmium.—Early in March the price of cadmium in the U.K. was reduced by 6d. a lb. to 9s. per lb. This reduction was mainly attributed to competition from material from U.S. sources. Cadmium has not been doing too well in the U.S.A. and quite large quantities have been offered for export, larger in fact than was thought when the price fell under 10s. per lb.

U.K. imports in February amounted to 242,575 lb.

Chromium.—This metal is still quoted in the range 6s. 11d.–7s. 4d., with no movements to record.

Tantalum.—Following the reduction in February to 650s.–700s. per unit this market has remained unchanged. However, bearing in mind that supplies are quite adequate a further reduction is not out of the question.

Platinum.—March saw further price increases in this market, Johnson Matthey first moving its price up to £28 10s., then Baker Platinum moving into line almost immediately after. On the open market prices were heard at around £27–£28 10s. per troy oz., but with no concrete deals reported. However, later in the month the situation clarified a little and open-market material is now quoted at £26 10s.–£27 10s. per troy oz.

Iridium.—Following the rise in platinum, iridium prices moved up and are now quoted at £24–£26 15s. per troy oz.

Palladium.—This member of the platinum family took heart from the general round of price increases and moved up to £7 5s. an oz., as compared with £5 15s. previously.

Osmium.—This metal may seem on the surface to have moved up disproportionately when compared with other platinum-group metals. It has risen to £23–£32 5s. per troy oz. However, this apparently large increase is explained by the fact that the lower end of the range is the increase made by sellers on the open market and the upper price is that at which leading producers are offering metal.

Tellurium.—This market has not altered since our last report and the price is quoted at 15s. to 16s. per lb.

Tungsten.—During March the tungsten ore market stagnated even further and right through the month the price remained at 84s.–89s. per long ton unit of WO_3.

Nickel.—This market has been very uninteresting during the past month and prices in the United Kingdom have not altered. Ingots are still quoted at £600 per ton.

Chromite.—Although there are rumours of the Turks once again becoming a market factor no concrete evidence of this has yet appeared, In the U.K. prices of Rhodesian ore have not yet been adjusted to the new freight rates and are still quoted at £15 15s. for 48% material.

Molybdenum.—Still quoted f.o.b. at 8s. 11d. per lb. of metal contained, this material offered no interesting news in March.

Manganese.—No improvement was recorded in this market during the past four weeks and with stocks building up in producing areas a rather easier tone has been noted. With very little business actually passing it is not too easy to evaluate the market although a nominal quotation of 70d. for 48% material seems fairly reliable.

Tin, Copper, Lead, and Zinc Markets

Tin, minimum 99·75%; Copper, electro; Lead, minimum 99·75%; and Zinc, minimum 98%, per ton.

Date	Tin		Copper		Lead		Zinc	
	Settlement	3 Months	Spot	3 Months	Spot	3 Months	Spot	3 Months
	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s	£ s.
Mar. 11	783 10	787 5	250 5	249 12½	70 12½	72 7½	76 1¼	74 6¼
12	782 0	785 5	250 17½	250 7½	69 16½	71 16½	75 13¾	74 3¾
13	781 10	784 5	251 2½	250 7½	69 6¼	71 6¼	75 8¾	74 3¾
16	782 10	785 5	255 12½	252 17½	69 12½	71 6¼	75 7½	74 2½
17	784 0	786 5	257 12½	255 12½	69 13¾	71 7½	75 17½	74 13¾
18	782 0	785 0	254 15	252 2½	69 7½	71 1¼	75 3¾	74 3¾
19	783 0	786 10	250 17½	248 12½	69 13¾	71 1¼	75 13¾	74 7½
20	782 0	785 15	245 17½	244 7½	68 17½	70 15	75 13¾	74 6¼
23	780 0	782 15	243 2½	242 12½	67 12½	69 15	74 1¼	73 3¾
24	775 0	780 5	245 2½	244 10	67 10	69 11¼	73 12½	73 3¾
25	774 10	778 15	247 2½	246 12½	66 8¾	68 8¾	73 7½	72 17½
26	776 0	780 10	246 5	246 5	67 15	69 12½	73 2½	72 17½
27	—	—	—	—	—	—	—	—
30	—	—	—	—	—	—	—	—
31	776 0	780 5	249 7½	249 2½	65 17½	68 7½	72 13¾	72 13¾
Apr. 1	781 0	782 15	249 5	248 17½	67 6¼	68 16¼	72 11¼	72 8¾
2	782 10	784 15	250 7½	250 7½	67 18¾	69 7½	71 2½	71 2½
3	782 10	784 15	249 17½	249 12½	68 8¾	70 1¼	71 8¾	71 8¾
6	782 10	785 5	250 15	250 12½	69 6¼	70 6¼	72 1¼	71 18¾
7	782 0	784 15	247 10	247 7½	68 17½	69 16¼	71 11¼	71 7½
8	783 0	785 5	247 15	247 15	69 7½	70 3¾	71 18¾	71 16¼
9	782 10	784 15	244 12½	244 12½	68 13¾	69 13¾	71 10	71 6¼

Statistics

TRANSVAAL AND O.F.S. GOLD OUTPUTS

	February		March	
	Treated Tons.	Yield Oz.*	Treated Tons.	Yield Oz.†
Blyvooruitzicht	108,000	70,987	120,000	77,520
Brakpan	126,000	15,194	141,000	17,000
Buffelsfontein‡	126,000	43,028	134,000	47,069
City Deep	107,000	22,366	114,000	23,950
Cons. Main Reef	110,000	19,050	125,000	20,419
Crown Mines	203,000	32,286	220,000	34,149
Daggafontein	230,000	47,035	242,000	49,352
Doornfontein‡	87,000	35,579	90,000	37,125
D'rb'n Roodeport Deep	175,000	32,232	184,000	34,136
East Champ D'Or‡	11,500	238	12,000	296
East Daggafontein	92,500	15,355	100,500	16,694
East Geduld	123,000	37,823	130,000	39,652
East Rand P.M.	201,000	52,000	221,000	56,906
Eastern Transvaal Consol	18,900	6,157	18,900	6,210
Ellaton‡	30,000	7,091	31,000	7,318
Freddies Consol.	53,000	13,594	56,000	14,173
Free State Geduld	75,000	57,335	79,000	61,764
Geduld	66,000	12,335	68,000	13,029
Government G.M. Areas‡	51,000	10,302	50,000	10,592
Grootvlei Proprietary	190,000	40,385	200,000	42,394
Harmony Gold Mining	102,000	40,920	115,000	45,732
Hartebeestfontein‡	84,000	45,570	87,000	46,980
Libanon	96,000	22,840	100,000	23,967
Loraine	75,000	14,625	75,000	14,625
Luipaards Vlei‡	117,000	13,759	123,000	14,100
Marievale Consolidated	83,000	21,179	92,000	22,978
Merriespruit‡	—	—	—	—
Modderfontein East	127,000	12,221	128,000	13,210
New Kleinfontein	78,000	10,167	83,000	10,898
New Klerksdorp‡	9,700	1,060	10,800	1,143
President Brand	95,000	72,584	100,000	77,504
President Steyn	93,000	36,382	99,000	38,330
Rand Leases	181,000	26,960	188,000	28,294
Randfontein‡	173,000	12,838	196,000	14,744
Rietfontein Consolid't'd.	16,000	4,252	16,000	4,132
Robinson Deep	64,000	12,862	66,000	13,709
Rose Deep	36,000	5,210	43,000	5,377
St. Helena Gold Mines	135,000	40,507	140,000	42,002
Simmer and Jack	84,000	16,791	84,000	15,316
S. African Land and Ex.	90,000	18,900	93,000	19,577
S. Roodepoort M.R.	28,000	6,762	29,000	6,979
Spaarwater Gold	10,500	3,301	10,700	3,395
Springs	99,000	13,740	104,000	14,286
Stilfontein Gold Mining‡	127,000	64,770	135,000	67,357
Sub Nigel	64,000	15,267	66,500	15,874
Transvaal G.M. Estates	6,300	1,868	6,800	1,983
Vaal Reefs‡	78,000	35,495	83,000	37,682
Van Dyk Consolidated	71,000	13,394	76,000	14,361
Venterspost Gold	125,000	31,631	130,000	32,253
Village Main Reef	26,300	4,782	26,500	4,780
Virginia O.F.S.‡	115,000	29,325	122,000	30,701
Vlakfontein	48,500	17,386	50,000	17,939
Vogelstruisbult‡	90,000	20,570	96,000	21,534
Welkom Gold Mining	90,000	27,762	95,000	29,230
West Driefontein‡	84,000	78,568	90,000	82,806
West Rand Consol.‡	194,000	—	214,000	21,740
Western Holdings	100,500	60,304	107,000	64,200
Western Reefs	110,500	28,730	121,000	31,460
Winkelhaak	66,000	15,246	69,000	16,794
Witwatersrand Nigel	17,400	4,213	18,100	4,366

† 248s. 9d. * 249s. 9d. ‡ Gold and Uranium.

COST AND PROFIT IN THE UNION

	Tons milled	Yield per ton	Work'g cost per ton	Work'g profit per ton	Total working profit
		s. d.	s. d.	s. d.	£
Dec.,* 1957	16,198,500	64 4	46 1	18 3	23,695,380
Jan., 1958.	—	—	—	—	—
Feb.	—	—	—	—	—
Mar.*	15,806,300	64 10	46 6	18 4	23,170,987
April	—	—	—	—	—
May	—	—	—	—	—
June*	16,435,500	64 9	46 6	18 3	24,358,945
July	—	—	—	—	—
August	—	—	—	—	—
Sept.*	16,760,400	65 10	46 9	19 1	25,633,898
Oct.	—	—	—	—	—
Nov.	—	—	—	—	—
Dec.	16,540,150	67 7	47 10	19 9	25,934,441

* 3 Months.

PRODUCTION OF GOLD IN SOUTH AFRICA

	Rand and O.F.S.	Outside	Total
	Oz.	Oz.	Oz.
April, 1958	1,401,094	38,352	1,439,446
May	1,435,960	36,494	1,472,454
June	1,408,384	39,187	1,447,571
July	1,456,925	42,312	1,499,237
August	1,463,259	36,413	1,499,672
September	1,465,697	36,799	1,502,496
October	1,516,701	44,025	,560,726
November	1,484,844	32,349	1,517,193
December	1,480,525	40,372	1,520,895
January, 1959	1,506,670	39,515	1,546,187
February	1,472,090	34,618	1,506,708
March	—	—	1 —

NATIVES EMPLOYED IN THE SOUTH AFRICAN MINES

	Gold Mines	Coal Mines	Total
July 31, 1958	336,356	31,608	367,964
August 31	334,815	31,924	366,739
September 30	333,380	31,978	365,358
October 31	335,003	32,657	367,660
November 30	332,443	32,851	365,294
December 31	329,234	32,946	362,180
January 31, 1959	350,656	—	—
February 28	396,217	33,859	430,076
March 31	—	—	—

MISCELLANEOUS METAL OUTPUTS

	4-Week Period To Mar. 7		
	Tons Ore	Lead Concs. tons	Zinc Concs. tons
Broken Hill South	27,300	4,328	4,893
Electrolytic Zinc	12,191	561	3,579
Lake George	18,073	1,441	2,749
Mount Isa Mines**	62,873	4,145†	1,286
New Broken Hill	56,600	8,630	11,028
North Broken Hill	32,379	6,192	6,526
Zinc Corp.	55,130	10,171	10,535
Rhodesia Broken Hill*	—	3,600†	7,275†

* 3 Mths. ** Copper 3,380 tons. † Metal.

RHODESIAN GOLD OUTPUTS

	February		March	
	Tons	Oz.	Tons	Oz.
Cam and Motor	31,570	—	—	—
Falcon Mines	20,000	3,700	20,000	3,761
Globe and Phœnix	6,000	2,889	6,200	3,033
Motapa Gold Mining	19,230	1,369	—	—
Mazoe	2,601	—	—	—
Coronation Syndicate	12,063	—	—	—
Phœnix Prince*	—	—	—	—

* 3 Months.

WEST AFRICAN GOLD OUTPUTS

	February		March	
	Tons	Oz.	Tons	Oz.
Amalgamated Banket	65,094	14,492	62,336	14,485
Ariston Gold Mines	39,000	12,726	40,000	12,546
Ashanti Goldfields	34,000	26,000	34,000	26,500
Bibiani	35,500	7,200	33,500	7,200
Bremang	—	4,695	—	3,791
Ghana Main Reef	11,441	4,491	11,668	4,346
Konongo	6,550	3,760	6,340	3,823
Lyndhurst	—	—	—	—

PRODUCTION OF GOLD AND SILVER IN RHODESIA

	1958		1959	
	Gold (oz.)	Silver (oz.)	Gold (oz.)	Silver (oz.)
January	44,305	46,553	46,489	18,077
February	43,591	21,313	43,366	19,806
March	43,830	8,179	—	—
April	46,587	22,573	—	—
May	46,015	19,937	—	—
June	46,453	20,105	—	—
July	44,244	19,170	—	—
August	47,484	20,549	—	—
September	48,295	21,141	—	—
October	46,311	6,342	—	—
November	47,994	16,435	—	—
December	48,888	30,724	—	—

WESTRALIAN GOLD PRODUCTION

	1957	1958	1959
	Oz.	Oz.	Oz.
January	106,722	66,562	63,924
February	64,949	65,965	65,035
March	67,121	65,420	—
April	66,435	60,855	—
May	64,886	64,196	—
June	65,142	67,929	—
July	74,420	81,106	—
August	75,727	68,610	—
September	64,422	68,744	—
October	64,524	70,128	—
November	65,700	67,562	—
December	66,562	120,106	—
Total	846,610	867,187	—

AUSTRALIAN GOLD OUTPUTS

	4-Week Period			
	To Feb. 17		To Mar. 17	
	Tons	Oz.	Tons	Oz.
Central Norseman	13,862	7,266	21,217	12,662†
Crœsus Proprietary	—	—	—	—
Gold Mines of Kalgoorlie	40,074	12,081	56,227	13,572†
Golden Horse Shoe*	—	—	—	—
Gt. Boulder Gold Mines*	—	—	—	—
Gt. Western Consolidated	29,915	5,000	47,089	8,999†
Hill 50*	—	—	—	—
Kalgurli Ore Treatment	—	—	—	—
Lake View and Star*	—	—	—	—
Moonlight Wiluna*	—	—	—	—
Morning Star (G.M.A.)	—	—	1,735	614
Mount Ida*	—	—	—	—
New Coolgardie	—	—	—	—
North Kalgurli	27,065	6,174	26,799	5,940
Sons of Gwalia	11,156	2,614	10,284	2,276
Mount Morgan	—	6,640	—	—

* 3 Months. † 6 Weeks to Mar. 31.

ONTARIO GOLD AND SILVER OUTPUT

	Tons Milled	Gold Oz.	Silver Oz.	Value Canad'n $
October, 1957	772,383	224,217	37,086	7,657,426
November	756,494	219,352	37,737	7,441,702
December	750,537	215,462	44,230	7,494,289
January, 1958	779,128	219,502	31,562	7,462,598
February	727,170	210,646	35,370	7,248,333
March	807,458	229,361	38,323	7,873,264
April	785,264	228,590	35,712	7,789,644
May	801,102	228,123	37,535	7,745,425
June	775,384	228,960	42,275	7,740,144
July	750,410	218,126	38,940	7,355,406
August	740,459	202,798	31,543	7,006,517
September	771,115	209,006	34,914	7,178,218
October	801,965	230,251	35,097	7,842,435
November	783,065	219,351	30,989	7,490,094
December	787,573	227,656	41,277	7,700,672
January, 1959	799,178	227,981	32,976	7,798,523

MISCELLANEOUS GOLD AND SILVER OUTPUTS

	Feb.		Mar.	
	Tons	Oz.	Tons	Oz.
British Guiana Cons.	—	—	—	—
Central Victoria Dredging	—	—	—	—
Clutha River	—	507	—	457
Emperor Mines (Fiji)*	—	—	—	—
Frontino Gold (Colombia)	—	—	—	—
Geita Gold (Tanganyika)	—	—	—	—
Harrietville (Aust.)	—	—	—	—
Lampa (Peru)†	—	38,056	—	37,436
Loloma (Fiji)*	—	—	—	—
New Guinea Goldfields	3,416	1,477	—	—
St. John d'el Rey (Brazil)	—	—	—	—
Yukon Consol.	—	—	—	—

* 3 Months. † Oz. Silver : Copper, 61 : 80½ tons.

OUTPUTS OF MALAYAN TIN COMPANIES IN LONG TONS OF CONCENTRATES

	Jan.	Feb.	Mar.
Ampat Tin	—	43½	50
Austral Amalgamated	—	—	—
Ayer Hitam	—	—	—
Batu Selangor	—	—	—
Berjuntai	128½	137½	112
Chenderiang	—	—	21*
Gopeng Consolidated	—	—	—
Hongkong Tin	—	—	41*
Idris Hydraulic	—	—	—
Ipoh	—	—	—
Jelapang Tin	—	—	—
Kampong Lanjut	52	47	87½
Kamunting	67	66	92
Kent (F.M.S.)	—	—	—
Kepong	—	—	—
Killinghall	—	—	53½*
Kinta Kellas	—	—	—
Kinta Tin Mines	—	—	—
Klang River	—	—	—
Kramat	—	—	—
Kuala Kampar	125	106	110
Kuala Lumpur	—	—	—
Kuchai	—	—	—
Lahat Mines	—	—	—
Larut	—	—	—
Lower Perak	17	67	46½
Malayan	—	—	—
Malaysiam	5	5½	—
Pacific Tin Consolidated	—	—	—
Pahang Consolidated	—	—	372*
Pengkalen	—	—	—
Petaling Tin	—	—	—
Puket	—	—	—
Rahman Hydraulic	—	—	—
Rambutan	—	—	—
Rantau	61	38	23
Rawang Concessions	—	—	—
Rawang Tin Fields	—	—	—
Renong	—	—	—
Selayang	—	—	35*
Siamese Tin Syndicate (Malaya)	13	25½	3
Southern Kinta	278½	218	217
Southern Malayan	—	—	—
Southern Tronoh	—	—	—
Sungei Besi	—	—	—
Sungei Kinta	—	—	—
Sungei Way	—	—	—
Taiping Consolidated	30	26	46
Tambah	—	—	—
Tanjong	—	—	—
Tekka	—	—	—
Tekka-Taiping	—	—	—
Temoh	—	—	—
Tongkah Compound	—	—	—
Tongkah Harbour	—	35½	26½
Tronoh	—	—	—
Ulu Klang	—	—	—

* 3 Months.

MISCELLANEOUS TIN COMPANIES' OUTPUTS IN LONG TONS OF CONCENTRATES

	February		March	
	Tin	Columbite	Tin	Columbite
Amalgamated Tin Mines	174	—	170	—
Anglo-Burma Tin *	25	—	—	—
Bangrin	30	—	34	—
Beralt	40	101†	34	114††
Bisichi	48½	13	38½	22
Ex-Lands Nigeria	31	—	32	—
Geevor	55	—	55	—
Gold and Base Metal	27	2	—	—
Jantar Nigeria	14	18	8	15
Jos Tin	9½	—	—	—
Kaduna Prospectors	3	—	3	—
Kaduna Syndicate	13	—	13½	—
Katu Tin	23	—	—	—
Keffi Tin	—	—	—	—
London Nigerian Mines	—	—	—	—
Mawchi Mines	—	—	—	—
Naraguta Extended	—	—	—	—
Naraguta Karama	—	—	—	—
Naraguta Tin	—	—	—	—
Renong Consolidated	—	—	—	—
Ribon Valley (Nigeria)	9	½	—	—
Siamese Tin Syndicate	13	—	53	—
South Bukeru	—	—	—	—
South Crofty	73	—	73	—
Tavoy Tin	—	—	—	—
Tin Fields of Nigeria	—	—	—	—
United Tin Areas of Nigeria	1½	1½	—	—

* 3 months. † Wolfram.

SOUTH AFRICAN MINERAL OUTPUT

December, 1958.

Gold	1,517,024 oz.
Silver	151,633 oz.
Diamonds	206,665 carats.*
Coal	3,535,748 tons.
Copper	(*a*) 10 tons in matte and copper-gold concentrates. (*b*) 4,435 tons of 99·34%.
Tin	242 tons concs.
Platinum (concentrates, etc.)	—
Platinum (crude)	—
Asbestos	15,912 tons.
Chrome Ore	60,775 tons.
Manganese Ore	92,116 tons.
Lead Concs.	— tons.

* Nov., 1958.

IMPORTS OF ORES, METALS, ETC., INTO UNITED KINGDOM

		January	February
Iron Ore	tons	1,016,376	878,563
Manganese Ore	,,	22,810	27,408
Iron and Steel	,,	25,906	30,491
Iron Pyrites	,,	19,739	13,153
Copper Metal	,,	39,960	31,433
Tin Ore	,,	2,576	3,447
Tin Metal	,,	324	280
Lead	,,	19,620	8,479
Zinc Ore and Conc.	,,	27,979	972
Zinc	,,	15,083	15,674
Tungsten Ores	,,	573	60
Chrome Ore	,,	11,406	18,324
Bauxite	,,	26,766	26,710
Antimony Ore and Concs.	,,	1,058	1,036
Titanium Ore	,,	26,983	23,664
Nickel Ore	,,	—	—
Tantalite/Columbite	,,	39	105
Sulphur	,,	32,496	21,772
Barytes	,,	2,469	3,088
Asbestos	,,	7,232	6,664
Magnesite	,,	1,386	1,430
Mica	,,	285	346
Graphite	,,	421	218
Mineral Phosphates	,,	78,151	100,066
Molybdenum Ore	,,	104	333
Nickel	cwt.	10,839	16,143
Aluminium	,,	358,207	353,890
Mercury	lb.	179,680	112,853
Bismuth	,,	104,985	90,418
Cadmium	,,	210,455	242,575
Cobalt and Cobalt Alloys	,,	105,512	193,901
Selenium	,,	8,308	5,726
Petroleum Motor Spirit	1,000 gals.	57,362	34,463
Crude	,,	838,617	824,777

Prices of Chemicals

The figures given below represent the latest available.

		£	s.	d.
Acetic Acid, Glacial	per ton	106	0	0
,, ,, 80% Technical	,,	97	0	0
Alum, Comml.	,,	25	0	0
Aluminium Sulphate	,,	16	10	0
Ammonia, Anhydrous	per lb.		2	0
Ammonium Carbonate	per ton	59	0	0
,, Chloride, 98%	,,	26	0	0
,, Phosphate (Mono- and Di-)	,,	102	0	0
Antimony Sulphide, golden	per lb.		3	0
Arsenic, White, 99/100%	per ton	47	10	0
Barium Carbonate (native), 94%	,,	Nominal		
,, Chloride	,,	53	0	0
Barytes (Bleached)	,,	20	0	0
Benzene	per gal.		5	2
Bleaching Powder, 36% Cl.	per ton	30	7	6
Borax	,,	44	0	0
Boric Acid, Comml.	,,	75	10	0
Calcium Carbide	,,	40	17	9
,, Chloride, solid, 70/75%	,,	13	5	0
Carbolic Acid, crystals	per lb.		1	6
Carbon Bisulphide	per ton	62	10	0
Chromic Acid (ton lots)	per lb.		2	2½
Citric Acid	per cwt.	11	0	0
Copper Sulphate	per ton	79	0	0
Creosote Oil (f.o.r. in Bulk)	per gal.		1	2
Cresylic Acid, refined	,,		6	10
Hydrochloric Acid 28° Tw.	per carboy		13	0
Hydrofluoric Acid, 59/60%	per lb.		1	1
Iron Sulphate	per ton	3	17	6
Lead, Acetate, white	,,	124	0	0
,, Nitrate	,,	116	0	0
,, Oxide, Litharge	,,	104	5	0
,, Red	,,	102	5	0
,, White	,,	114	15	0
Lime Acetate, brown	,,	40	0	0
Magnesite, Calcined	,,	20	0	0
,, Raw	,,	9	0	0
Magnesium Chloride, ex Wharf	,,	16	0	0
,, Sulphate, Comml.	,,	15	10	0
Methylated Spirit, Industrial, 66 O.P.	per gal.		6	3
Nitric Acid, 80° Tw.	per ton	37	10	0
Oxalic Acid	,,	129	0	0
Phosphoric Acid (S.G. 1·750)	per lb.		1	4
Pine Oil	per ton	Nominal		
Potassium Bichromate	per lb.		1	2½
,, Carbonate (hydrated)	per ton	74	10	0
,, Chloride	,,	21	0	0
,, Iodide	per lb.		7	3
,, Amyl Xanthate	,,	Nominal		
,, Ethyl Xanthate	,,	Nominal		
,, Hydrate (Caustic) flake	per ton	118	0	0
,, Nitrate	per cwt.	4	1	0
,, Permanganate	per ton	193	10	0
,, Sulphate, 50%	,,	21	1	0
Sodium Acetate	,,	99	0	0
,, Arsenate, 58–60%	,,	Nominal		
,, Bicarbonate	,,	15	0	0
,, Bichromate	per lb.		1	0
,, Carbonate (crystals)	per ton	Nominal		
,, ,, (Soda Ash) 58%	,,	13	15	0
,, Chlorate	,,	91	0	0
,, Cyanide 100% NcAN basis	per cwt.	6	6	6
,, Hydrate, 76/77%, solid	per ton	33	0	0
,, Hyposulphite, Comml.	,,	32	15	0
,, Nitrate, Comml.	,,	29	0	0
,, Phosphate (Dibasic)	,,	40	10	0
,, Prussiate	per lb.		1	0½
,, Silicate	per ton	11	0	0
,, Sulphate (Glauber's Salt)	,,	9	15	0
,, ,, (Salt-Cake)	,,	10	0	0
,, Sulphide, flakes, 60/62%	,,	38	12	6
,, Sulphite, Comml.	,,	27	10	0
Sulphur, American, Rock (Truckload)	,,	15	0	0
,, Ground, Crude	,,	17	10	0
Sulphuric Acid, 168° Tw.	,,	13	0	0
,, ,, free from Arsenic, 140° Tw.	,,	8	0	0
Superphosphate of Lime, 18% P_2O_5	,,	14	18	6
Tin Oxide	,,	Nominal		
Titanium Oxide, Rutile	,,	172	0	0
,, White, 25%	,,	85	0	0
Zinc Chloride	,,	95	0	0
,, Dust, 95/97% (4-ton lots)	,,	109	0	0
,, Oxide	,,	95	10	0
,, Sulphate	,,	32	0	0

Share Quotations

Shares of £1 par value except where otherwise stated.

GOLD AND SILVER:	Mar. 10, 1959 £ s. d.	Apr. 8, 1959 £ s. d.
SOUTH AFRICA:		
Blinkpoort (5s.)	3 18 9	4 7 6
Blyvooruitzicht (2s. 6d.)	1 4 9	1 7 0
Brakpan (5s.)	5 0	5 0
Buffelsfontein (10s.)	2 6 6	2 6 9
City Deep	16 6	17 0
Consolidated Main Reef	18 0	1 0 3
Crown Mines (10s.)	1 4 9	1 4 0
Daggafontein (5s.)	1 7 3	1 8 3
Dominion Reefs (5s.)	14 9	15 0
Doornfontein (10s.)	1 11 0	1 11 6
Durban Roodepoort Deep (10s.)	1 13 3	1 13 6
East Champ d'Or (2s. 6d.)	2 0	2 0
East Daggafontein (10s.)	8 6	8 6
East Geduld (4s.)	1 2 6	1 3 3
East Rand Ext. (5s.)	1 8 9	1 11 3
East Rand Proprietary (10s.)	2 1 3	2 2 0
Freddies Consol.	3 3	2 6
Free State Dev. (5s.)	10 3	10 0
Free State Geduld (5s.)	7 12 3	8 13 9
Free State Saaiplaas (10s.)	17 6	18 6
Geduld	3 2 6	3 2 0
Government Gold Mining Areas (4s.)	4 3	3 9
Grootvlei (5s.)	17 6	17 3
Harmony (5s.)	2 1 0	2 1 9
Hartebeestfontein (10s.)	3 5 6	3 5 6
Libanon (10s.)	9 3	9 3
Loraine (10s.)	1 11 9	1 11 3
Luipaards Vlei (2s.)	9 3	9 6
Marievale (10s.)	1 5 6	1 5 6
Merriespruit (5s.)	6 3	7 6
Modderfontein B (3s.)	2 3	2 3
Modderfontein East	15 9	15 6
New Kleinfontein	4 6	4 6
New Pioneer (5s.)	1 19 6	2 1 3
New State Areas (15s. 6d.)	2 0	2 0
President Brand (5s.)	3 2 3	3 8 6
President Steyn (5s.)	1 11 6	1 12 9
Rand Leases (9s. 3d.)	7 6	7 0
Randfontein	1 4 6	1 4 6
Rietfontein (3s. 2d.)	5 9	6 3
Robinson Deep (5s. 6d.)	7 9	7 3
Rose Deep (6s. 6d.)	13 0	12 9
St. Helena (10s.)	2 14 3	2 17 9
Simmer and Jack (1s. 6d.)	3 0	2 6
South African Land (3s. 6d.)	1 0 9	1 0 9
Springs (5s.)	1 9	1 9
Stilfontein (5s.)	2 5 0	2 3 6
Sub Nigel (8s. 6d.)	13 9	13 0
Vaal Reefs (5s.)	1 18 6	1 19 0
Van Dyk (7s. 9d.)	4 9	5 0
Venterspost (10s.)	16 6	17 0
Virginia (5s.)	8 6	7 9
Vlakfontein (10s.)	17 6	17 6
Vogelstruisbult (10s.)	8 3	8 6
Welkom (5s.)	18 3	1 0 3
West Driefontein (10s.)	5 17 6	6 5 0
West Rand Consolidated (10s.)	1 4 0	1 4 6
West Witwatersrand Areas (2s. 6d.)	2 13 6	2 14 6
Western Holdings (5s.)	6 10 0	7 1 3
Western Reefs (5s.)	1 8 0	1 8 6
Winkelhaak (10s.)	1 0 3	1 1 6
Witwatersrand Nigel (2s. 6d.)	1 3	1 3
Zandpan (10s.)	1 0 6	19 3
RHODESIA:		
Cam and Motor (2s. 6d.)	8 0	7 9
Chicago-Gaika (10s.)	15 0	15 0
Coronation (2s. 6d.)	4 0	4 0
Falcon (5s.)	7 6	7 3
Globe and Phœnix (5s.)	1 9 6	1 9 6
Motapa (5s.)	9	9
GOLD COAST:		
Amalgamated Banket (3s.)	1 0	1 2
Ariston Gold (2s. 6d.)	4 9	4 9
Ashanti Goldfields (4s.)	17 9	1 0 0
Bibiani (4s.)	2 3	2 3
Bremang Gold Dredging (5s.)	1 6	1 9
Ghana Main Reef (5s.)	2 0	2 3
Konongo (2s.)	1 9	1 11
Kwahu (2s.)	3 9	3 6
Western Selection (5s.)	5 9	5 6
AUSTRALASIA:		
Gold Fields Aust. Dev. (3s.), W.A.	2 0	2 0
Gold Mines of Kalgoorlie (10s.)	8 6	8 6
Great Boulder Propriet'y (2s.), W.A.	12 6	12 6
Lake View and Star (4s.), W.A.	1 3 9	1 6 0
London-Australian (2s.)	9	9
Mount Morgan (10s.), Q.	13 3	13 3
New Guinea Gold (4s. 3d.)	2 0	2 0
North Kalgurli (1912) (2s.), W.A.	10 0	10 6
Sons of Gwalia (10s.), W.A.	2 6	2 6
Western Mining (5s.), W.A.	10 0	10 3

	Mar. 10, 1959 £ s. d.	Apr. 8, 1959 £ s. d.
MISCELLANEOUS:		
Fresnillo ($1·00)	1 15 0	1 15 0
Kentan Gold Areas	1 19 6	2 0 9
St. John d'el Rey, Brazil	3 15 0	4 5 3
Yukon Consolidated ($1)	4 9	5 0
COPPER:		
Bancroft Mines (5s.), N. Rhodesia	1 7 6	1 9 3
Esperanza (2s. 6d.), Cyprus	2 0	1 10½
Indian (2s.)	4 3	5 0
MTD (Mangula) (5s.)	10 0	9 9
Messina (5s.), Transvaal	5 11 3	5 17 6
Mount Lyell, Tasmania	1 6 0	1 4 3
Nchanga Consolidated, N. Rhodesia	10 15 0	10 16 3
Rhokana Corporation, N. Rhodesia	26 5 0	26 5 0
Roan Antelope (5s.), N. Rhodesia	9 0	8 9
Tanganyika Concessions (10s.)	2 8 9	2 7 6
LEAD-ZINC:		
Broken Hill South (5s.), N.S.W.	2 6 0	2 6 3
Burma Mines (3s. 6d.)	2 3	2 3
Consol. Zinc Corp. Ord.	3 0 0	3 1 3
Lake George (5s.), N.S.W.	3 6	3 6
Mount Isa, Queensland (5s. Aust.)	1 10 6	1 11 3
New Broken Hill (5s.), N.S.W.	1 13 9	1 12 3
North Broken Hill (5s.), N.S.W.	3 15 0	3 18 6
Rhodesia Broken Hill (5s.)	8 9	8 6
San Francisco (10s.), Mexico	16 6	19 6
TIN:		
Amalgamated Tin (5s.), Nigeria	7 0	6 9
Ampat (4s.), Malaya	8 0	8 3
Ayer Hitam (5s.), Malaya	1 11 6	1 13 0
Beralt (5s.), Portugal	1 7 0	1 9 0
Bisichi (2s. 6d.), Nigeria	3 3	3 3
Ex-Lands (2s.), Nigeria	2 0	2 0
Geevor (5s.), Cornwall	19 3	1 0 0
Gold Base Metals (2s. 6d.), Nigeria	1 0	1 0
Hongkong (5s.), Malaya	4 3	5 3
Jantar Nigeria (3s.)	3 3	3 3
Kaduna Syndicate (2s.), Nigeria	2 2	2 0
Kamunting (5s.), Malaya	10 9	10 9
Malayan Tin Dredging (5s.)	15 0	15 6
Mawchi Mines (4s.), Burma	1 6	2 6
Naraguta Extended (5s.), Nigeria	9	9
Pahang (5s.), Malaya	4 6	4 9
Siamese Synd. (5s.)	7 9	8 9
South Crofty (5s.), Cornwall	3 10½	4 0
Southern Kinta (5s.), Malaya	1 0 3	1 1 9
Southern Malayan (5s.)	12 6	13 3
Southern Tronoh (5s.), Malaya	11 6	11 6
Sungei Besi (4s.), Malaya	16 6	17 9
Sungei Kinta, Malaya	13 6	14 0
Tekka (12s. 6d.), Malaya	4 3	4 3
Tronoh (5s.), Malaya	12 6	13 0
United Tin Areas (2s. 6d.), Nigeria	6	7½
DIAMONDS:		
Anglo American Investment	11 2 6	11 15 0
Consol African Selection Trust (5s.)	15 6	17 9
Consolidated of S.W.A. Pref. (10s.)	10 6	10 6
De Beers Deferred (5s.)	6 2 6	6 8 9
FINANCE, Etc.		
African & European (10s.)	4 2 6	4 5 0
Anglo American Corporation (10s.)	8 10 0	8 15 0
Anglo-French Exploration	1 5 0	1 7 9
Anglo Transvaal 'A' (5s.)	2 0 9	2 1 0
British South Africa (15s.)	4 0 0	4 6 0
British Tin Investment (10s.)	19 9	19 9
Broken Hill Proprietary	2 3 0	2 5 0
Camp Bird (10s.)	12 9	13 3
Central Mining	3 11 9	3 16 3
Central Provinces Manganese (10s.)	1 12 6	1 12 6
Consolidated Gold Fields	3 4 9	3 6 0
Consolidated Mines Selection (10s.)	2 2 0	1 19 6
East Rand Consolidated (5s.)	2 0	2 0
Free State Development (5s.)	10 3	10 0
General Exploration O.F.S. (2s. 6d.)	5 3	5 3
General Mining and Finance	6 0 0	6 12 3
H.E. Proprietary (5s.)	16 0	16 0
Johannesburg Consolidated	2 16 6	2 18 6
London & Rhod. M. & L. (5s.)	7 9	7 6
London Tin Corporation (4s.)	8 3	9 0
Lydenburg Est. (5s.)	16 0	17 0
Marsman Investments (10s.)	1 9	1 9
National Mining	1 9	1 9
Rand Mines (5s.)	4 6 6	4 7 9
Rand Selection (5s.)	2 6 9	2 10 0
Rhodesian Anglo American (10s.)	3 18 9	3 15 0
Rhodesian Corporation (5s.)	3 6	3 3
Rhodesian Selection Trust (5s.)	16 6	15 6
Rio Tinto (10s.)	2 13 0	2 11 3
Selection Trust (10s.)	5 1 9	5 2 0
South West Africa Co. (3s. 4d.)	13 9	13 9
Union Corporation (2s. 6d.)	2 10 0	2 13 9
Vereeniging	6 0 6	5 18 9
West Rand Inv. Trust (10s.)	2 16 0	2 15 6

THE MINING DIGEST

A RECORD OF PROGRESS IN MINING, METALLURGY, AND GEOLOGY

In this section abstracts of important articles and papers appearing in technical journals and proceedings of societies are given, together with brief records of other articles and papers; also notices of new books and pamphlets and lists of patents on mining and metallurgical subjects.

Oxygen in Zinc Concentrate Roasting

A paper by J. A. B. Forster and R. J. Cooper in the *Proceedings* of the Australasian Institute of Mining and Metallurgy for December, 1958 (No. 188) describes the use of "By-Product Oxygen as a Stimulant in Zinc Concentrate Roasting." The work relates to the roasting installation at the Risdon works of the Electrolytic Zinc Co. of Australasia, Ltd., where zinc sulphide concentrate is roasted autogenously for removal of sulphur in two hearth roasters and four flash roasters. The hearth roasters, of modified Skinner type with eleven hearths, were designed and are used for roasting mixtures of relatively low sulphide content. The flash roasters are down-draughted furnaces with cross-section and rabbling equipment based on the hearth roaster design. They are 20 ft. in diameter with three drying hearths through which hot gas is drawn from the combustion chamber by the burner fan. The combustion chamber is 21 ft. high above the collecting hearth (27 ft. in No. 4 unit) and the discharge hearth below it is 6 ft. high, so that a large gas offtake is possible. Four rabble arms for each hearth are carried on a central column. Dried ground concentrate and the air for roasting it are fed to a burner pipe delivering horizontally and radially near the top of the combustion chamber. Concentrate discharged from the third drying hearth is dry ground by a ball-mill in closed circuit with a pneumatic classifier to about 94% *minus* 325 mesh (Tyler) and an average particle size of 4 microns. A boiler, cyclones, and electrostatic precipitator cool and clean the gas, collected dust being returned to the collecting hearth of the furnace. Other equipment comprises feed bins, conveyors for feed, collected dust, and the calcine product, boiler auxiliaries including water softening plant, and fans for movement of gas.

The first two units were designed for a feed rate of 150 tons (long) of concentrate per day with calcine at 4% total sulphur. In practice roasting efficiency was substantially better and in 1954–55 at feed rates averaging 171 tons per operating day throughout the year exceeded 150 tons per furnace per day at 97·3% roasting efficiency, although the furnaces operated under distinctly inadequate draught. Consequently gas moving and cleaning equipment for the third roaster was designed for a feed rate of 180 tons per day. In the fourth roaster the combustion chamber was made nearly 30% higher and auxiliary equipment provided for roasting 240 tons per operating day.

As the stage of treatment subsequent to roasting is leaching in dilute sulphuric acid for the extraction of zinc, the efficiency of roasting should be assessed as the percentage solubility in dilute acids. In practice some zinc, especially that associated with iron as marmatite, forms zinc ferrite which is insoluble in dilute acid. The extent of ferrite formation varies with the nature of the concentrate used and is not susceptible to control in the roasting processes used. For this reason the percentage elimination of sulphide is used as a measure of roasting efficiency.

The efficiency of the flash roasting process depends on a number of factors. Important in determining roasting efficiency are the fineness of the concentrate fed to the combustion chamber; speed of ignition and time of passage through the furnace; oxygen and sulphur dioxide concentrations in the gas phase; the temperature reached in the combustion chamber, and effective dispersal of concentrate in the gas phase. One other important factor is the steadiness of operating conditions.

The minimum temperature for satisfactory operation is 950° C., but the optimum may be 1,000° C. or more. Temperatures may be raised by reducing air input and this serves to illustrate the interdependence of conditions. Reduction of air input reduces oxygen concentration and increases sulphur dioxide concentration, but the adverse effect of these movements on roasting rate may be more than countered by the effect of higher speed of ignition and increased diffusion rates.

The average time of passage through the combustion chambers ranges from 9 sec. to 11 sec., so that speed of ignition must obviously be an important factor. Since roasting is not an instantaneous process and considering that there may be from 230 lb. to 350 lb. of concentrate and 690 lb. to 1,050 lb. of air entering a furnace each minute, the means by which ignition is maintained is not readily evident. Conditions are entirely different from those of the original pyrites flash roaster in which a small fraction of the air required is added with the concentrate and the remainder moves upward countercurrent to the roasting material.

It has been suggested that the column, which has a protective covering of firebrick tiles, acts as a hot spot, but a little consideration indicates this is extremely unlikely. The column is cooled internally and in the upper parts of the furnace opposite the burner the temperature is well below ignition point. The upper part of the column face therefore

probably passes through a relatively cool zone. To make the column an effective hot spot it would be necessary for sufficient heat to be conducted upwards through the tiles to raise an appreciable part of the incoming air and concentrate from less than 100° C. to about 950° C.

A number of observations has led to the belief that ignition is maintained by an upward movement of gas close to the wall on the burner side from the lower part of the combustion chamber toward the burner and induced by the jet effect of the burner. The observations supporting this theory are :—

(1) Temperatures near the wall a short distance to the side of the burner are normally above ignition temperature, whereas opposite the burner they are well below it.

(2) The chamber brick-work becomes heavily penetrated with lead fume and in this condition is subject to slagging, especially when temperature rises to much above 1,050° C. Slagging is most extensive on the burner side of the furnace with the maximum a few feet above the collecting hearth. It is relatively slight over an arc of about 120° opposite the burner.

(3) Operation is most satisfactory when the furnace is so lightly draughted that there is a slight positive pressure in the combustion chamber. A very slight negative pressure may be tolerated but the furnace is then very sensitive to further increase of draught which, even for a short period, causes ignition to cease. This " loss of flash," indicated by a sudden drop of temperature, will be preceded by a slow decrease of temperature near the wall at a short distance from the burner.

(4) The " bottling up " of the combustion chamber by the collecting hearth is believed to be useful in maintaining the required drafting condition and the upward recirculation of gas. It has been reported from U.S.A. that the feed rate had to be reduced appreciably when a furnace was operated without replacement of a collapsed hearth. This theory of maintenance of ignition has been discussed at some length because it plays an important part in the consideration of methods of applying oxygen enrichment to flash roasting.

The production of ammonia at Risdon from atmospheric nitrogen and electrolytic hydrogen has made available a substantial amount of by-product oxygen, for which an obvious use is the improvement of roasting efficiency. At Risdon flash roasting efficiency was already high when considered in relation to tonnage roasted, probably due to the relatively fine grinding of concentrate. However, hearth roasting efficiency was much lower and the use of oxygen in the hearth roasters offered correspondingly greater opportunities of benefit.

The first application of the initial small quantities of oxygen available, apart from use in a residue retreatment roaster, was to be hearth roasters. In hearth roasting of zinc concentrates carried on autogenously or nearly so roasting rate is roughly proportional to the sulphur content of the material in the hearth bed and therefore falls off rapidly in the lower hearths of the furnace with consequent decrease of temperature. Heavy oxygen enrichment is therefore possible near the bottom of the furnace without risk of undue temperature rise and offers the advantages inherent in a countercurrent process. It was decided to add the oxygen to the tenth hearth so that the final hearth would be available for some cooling of the calcine before it reached the discharge conveyor. This has proved very satisfactory.

A little air is added to the bottom hearth to assist cooling, oxygen only is added to the tenth hearth, and air is supplied to the hearths above as needed to regulate temperatures. The oxygen addition amounts to 200 cu. ft. to 225 cu. ft. per min. per furnace, equivalent to 35% to 38% of the theoretical requirement of the roast.

Oxygen enrichment also offers a very great advantage when much temperature has been lost during a prolonged stoppage. As soon as temperature is raised to above 600° C. at some point in the furnace the pick-up is rapid if oxygen is admitted and calcine grade should be nearly normal during the reheating process. Oxygen should not be added while an oil burner is in use as serious local overheating can result but rise of temperature may be expedited by the addition of small amounts of an oil-sawdust mixture to the middle hearths at frequent intervals until the concentrate is roasting freely with temperatures of 650° C. to 700° C. in two or three hearths. Thereafter, with careful increase of air input, the furnace can be brought to normal temperatures within a few hours.

Owing to the higher temperatures maintained in the lower hearths it is necessary to renew the sand beds on the hearths from No. 6 downwards as frequently as those of Nos. 4 and 5 hearths which have always been the hottest in the furnace—*i.e.*, at three-monthly instead of six-monthly intervals as hitherto.

As it was anticipated that the oxygen available for the flash roasters might not be more and possibly less than 100 cu. ft. per min. per furnace, it did not appear that any considerable benefit would result if the oxygen were added to the air supply to the burners which is the practice at Trail. The combustion chambers at Risdon are 1·12 times the volume of those at Trail, being of smaller diameter, but higher. This circumstance, together with finer grinding of concentrate, probably accounts for roasting efficiencies at Risdon without oxygen enrichment being higher than those at Trail at the same tonnage rate with oxygen added at 200 cu. ft. per min. The Trail results show that the higher the roasting efficiency the greater the amount of oxygen enrichment needed to eliminate an additional unit of sulphur at a given feed rate. In normal operation without oxygen enrichment the air requirement ranges from somewhat below 50% in excess of the theoretical amount at low feed rates to perhaps 60% at high rates, or from 2·2 to 2·4 tons of oxygen per ton of sulphur eliminated. In the Risdon hearth roasters enriching oxygen was being used at the rate of 6 to 7 tons per ton of additional sulphur oxidized and it seemed extravagant to use available oxygen at three or four times this rate without exploring other methods of application.

Two possible methods were envisaged. The first was to bring the oxygen at the highest possible concentration into contact with the calcine leaving the furnace using countercurrent flow. It was decided to attempt this by feeding oxygen to the discharge end of a covered screw conveyor. Stirring vanes were fixed to the flights of the screw, the conveyor shaft was water-cooled, and the trough was water-jacketed.

The actual results could not be assessed as the oxygen moved counter to the calcine right back to the furnace and samples of calcine prior to contact with oxygen could not be obtained. The evolution

of heat, however, left no doubt that this application was achieving the desired result. In fact, its success led to its abandonment as far as this installation was concerned. When the sulphide sulphur in calcine rose above normal level the cooling became inadequate and the calcine hot enough to cause sticking to the flights of the screw; on occasions the build-up practically choked the conveyor.

Countercurrent flow of calcine and oxygen remains the most logical method of utilization of oxygen. Its application possibly requires different and more specialized equipment which may not be easy to install in existing plants but the problems of design involved are certainly not insuperable.

The second method involved the theory of the hot spot. If the volume of oxygen available is of the order of ½% to 1% of the air input its addition to the burner will, in the light of Trail's results, have little effect on roasting efficiency. On the other hand, if it is fed into the up-cast flow of hot gas close to the burner there is every possibility that it will create a fairly high local concentration which will stimulate the ignition process.

The oil burner port of the furnace is in an appropriate position on one side of the concentrate burner and has been used for the purpose. Visual observations indicate a distinct local increase of temperature from this application of oxygen but roasting results suggest that there is no advantage in adding more than 50 cu. ft. per min. to a side port; additional oxygen, if available, is more useful added to the burner fan.

One furnace has been fitted with a second side port so that oxygen can be fed to each side of the burner, but at the date of writing controlled tests on the effect of using two side ports have not been made.

The authors say that it is only a few months since oxygen first became available to the flash roasters and during this time there have been changes in the volume available and necessary changes of feed rate. In consequence there are insufficient performance figures available for comparable conditions to enable the benefits derived to be assessed accurately. Whatever indications there are as to the effect of larger volumes of oxygen added to the burner fan come mainly from No. 4 unit, where 50 cu. ft. to 100 cu. ft. per min. has been added at the one side port and the remainder available through the burner fan. At 200 tons feed per day 150 cu. ft. to 200 cu. ft. per min. added oxygen increased roasting efficiency from about 96% to 97·5% to 98%. An addition of 300 cu. ft. to 400 cu. ft. per min. enabled this higher efficiency to be maintained when the feed rate was raised to 225 tons per day.

Re-Tipping Steels by Salt-Bath Brazing

A note in the *Chemical Engineering and Mining Review* of Melbourne for January 15 taken from the Zinc Corporation and New Broken Hill Consolidated house magazine gives an account of the method now employed to re-tip worn drill steels. The project has arisen out of a programme of research at the Zinc Corporation designed to cut down overall drilling costs. These investigations—although not complete—have, it is stated, already pointed the way to procedure changes which have reduced the cost of drilling from 7·7d. per ft. to 5·4d. per ft. Zinc Corporation, Ltd., and New Broken Hill Consolidated, Ltd., drill about 2,000,000 ft. a year, or more than a mile and a half for each working day. The secret of the achievement is simple enough, drill steels with broken or worn-out cutting tips being now given a new lease of life by inserting new tips.

Briefly, the stages leading to the use of the present drill-steels were as follows:—

Old-type conventional carbon-steels with a forged integral head did not hold their cutting edge and were frequently reforged at the surface.

They were replaced by steels carrying an easily-detached, throw-away bit-head, which was discarded when blunt and a new one fitted on the job.

The present drill steels were introduced, incorporating an integral tungsten-carbide tip. They can be re-ground when blunt, until eventually the hard insert is worn down. Tests were conducted and Sandvik Coromant type CL-426 was adopted. The use of this type of drill for a number of years has built up a stock-pile of full-length steels which are sound, except for a worn or broken tip.

Early in 1954 experiments were started to see whether these large quantities of steel could be reused by brazing new tips to the heads. The first difficulty was to form the new steel head while effectively closing the water-hole to provide a solid back for the insert. This was accomplished after many changes had been made to the forging dies.

The next problem was to select a suitable brazing method to achieve a sound bond between the steel and the tungsten carbide. It was also necessary to choose a brazing alloy which would allow the brazing and re-hardening of the steel to be done in one operation. The alloy chosen had a composition of 99% copper and 1% silver, but investigations are still going ahead to find an alloy with improved "wetting characteristics," as a good braze depends on the alloy flowing freely between the two surfaces and sticking firmly to both. Steel is relatively easy to "wet," but tungsten carbide is more difficult.

Use of Salt Bath

It was decided that the solution to the brazing problem might be found by using a bath of molten salt. Normally used for heat treatment, salt baths had been used overseas for some specialized brazing operations but there was no record of their use in this application. Preliminary tests with an existing oil-fired salt bath gave promising results and eventually an electrically-heated furnace was purchased. Concurrently tests were being carried out to select a suitable grade of tungsten carbide.

Another critical factor affecting the re-tipping process was the method of forming the slot in the head of the steel. Many methods were considered, the one finally adopted being to forge the head as a blank, the slot being formed by cold milling.

Because of the punishing blows which the carbide tip must transmit as it is pounded into the rock it must sit squarely in the slot and it is essential that the bottom of the slot should have a smooth surface. Here, briefly, is the procedure for the whole re-tipping operation.

(1) The old tip is cut from the end of the steel, which is then heated to between 1,050° and 1,100° C. in a drill-heating furnace and the new head forged.

(2) The forged end is then softened for machining by heating in a lead bath for 20 min. at a temperature of 720° to 730° C. The slot is milled in two cuts to smooth out chatter marks. The finished slot is $\frac{17}{32}$ in. deep and 0·420 in. wide.

(3) The axial water-hole in the drill is opened up by drilling an angled hole from the side of the head, about 1 in. back from the end, to meet the central hole.

(4) The slot is thoroughly cleaned with carbon tetrachloride to remove all grease. This treatment is also given to the other components—the brazing alloy and the carbide insert.

(5) The parts are assembled. The copper brazing alloy strip ($1\frac{1}{2}$ in. by $\frac{5}{16}$ in. by $\frac{1}{8}$ in.) is laid in the bottom of the slot and the tungsten-carbide tip placed in position. Mild-steel U-shaped spacers are clipped over the insert to centre it in the slot and vertical and horizontal wire cradles are fitted to prevent it slipping out of position.

(6) Carbon tetrachloride is again brushed over the assembly and the drills are inverted in the salt bath at a temperature of 1,120° C. with the tips resting on a platform submerged 3 in. below the surface. This depth is carefully chosen to overlap the original annealing, as there would otherwise be a zone of softened steel which would lead to early failure.

(7) The drills remain in the bath for 3 min. to allow the brazing alloy to melt. Each drill is then pressed down firmly on the platform to squeeze the alloy thinly around the insert, after which the platform carrying the drills is lifted just above the salt and left there for 45 seconds while the copper solidifies.

(8) Compressed air is forced through the water-holes to clear away any salt and the drills are allowed to air cool to harden them.

(9) The tips are ground to an angle of 110°.

To sum up, salt-bath brazing has the following advantages.

Uniform heating and close temperature control.

Exclusion of all air during brazing.

Continued exclusion of air after drills are lifted from bath, due to crust of salt solidifying around the hot metal, thus preventing scaling.

Heat shock avoided when immersing drills, as salt forms an insulating crust around the steel until it heats up.

A Lead-Zinc Mill in Missouri

A recent Information Circular of the United States Bureau of Mines—No. 7875—describes "Mining and Milling Methods and Costs at the Indian Creek Mine, St. Joseph Lead Co., Washington County, Missouri." The authors—C. R. Christiansen, W. H. Calhoun, and W. F. Brown—say that this mine is the first important producer of lead ore at depth in Washington County. The nearest similar ore deposit is in the northern part of the south-east Missouri lead belt, about 25 miles to the south-east, in western St. Francois County. Development of the Indian Creek deposit was begun in 1950 and by mid-1954 the property, equipped with one of the country's most modern mining and milling plants, was in full operation. Mining is done entirely with trackless equipment, powered by diesel engines or electric motors. The hoisting shaft was the first circular, concrete-lined shaft to be sunk in the lead district. The shaft was sunk by the company without a lost-time accident.

The ore at Indian Creek is galena associated with small quantities of sphalerite and marcasite disseminated in Bonneterre dolomite of Upper Cambrian age. The main controlling feature of the lead-zinc mineralization was a domal or anticlinal structure related to a buried Precambrian rhyolite-porphyry ridge. The eroded surface of the porphyry was buried progressively by Upper Cambrian sediments, beginning with the Lamotte sandstone. At Indian Creek, as in other south-east Missouri areas, the higher Precambrian topographic features were not completely covered by the Lamotte formation, which wedges out against the ridges and, in turn, is covered by the Bonneterre dolomite. The line along which the Lamotte wedges out against the porphyry is called "the pinchout" and ore deposition occurred in the Bonneterre formation above this line. Thus the mineralized area is in the form of an irregular band, roughly paralleling the crest of the buried ridge.

Where ore bearing, the Bonneterre formation comprises two zones. The main body of the formation is dense, massive dolomite. Near its central part the formation consists of an irregularly bedded, mottled, fingered dolomite, believed to be of algal origin. Both zones are relatively free from vugs, vaults, joints, and other structural weaknesses.

The ore deposit developed is more than 4,000 ft. long and has a maximum width of 600 ft. Drilling indicates that the ore-bearing zone is as much as 150 ft. thick in places; however, where the zone is uncommonly thick the ore occurs in layers separated by waste. The total thickness of ore in the deposit ranges from 8 ft. to about 60 ft. Individual ore-bodies are irregular in size, shape, and dip, necessitating selective mining to avoid inclusion of excessive waste rock. Development on two or more levels is required to mine the separate ore horizons.

The deposit was discovered by prospect diamond drilling. More than 400,000 ft. of prospect holes was drilled over a period of four years in Washington County before the first "payhole" was drilled in April, 1948. By April, 1950, enough ore had been disclosed to warrant development of the deposit. Such holes are not put down on a standard pattern but are spotted by the geologist in conformity with his judgment. The holes usually are spaced at 300 ft. to 600 ft. intervals. Prospecting and exploration by drilling are done continuously, both on the surface and from underground workings. A diamond-drilling contractor and two contract churn-drilling crews work on vertical holes from the surface in the Indian Creek area. One diamond drill is used underground for drilling holes laterally from mine openings. Hammer drills are used occasionally to test areas above the roofs and below the floors of stopes for ore.

Ore is mined in open stopes with irregularly spaced pillar support. A three-compartment,

circular hoisting shaft and a circular auxiliary shaft, 3,000 ft. apart, provide access to the mine. The two shafts are connected by a haulage drive, which has an ascending grade of 2% from the hoisting shaft. Other drives radiate from the shaft station or branch off from the main haulageways to the various stopes. In parts of the mine where ore horizons are separated by lean or barren rock, the ore is developed and mined on two or more levels.

Most of the broken ore is loaded into trucks at the face and hauled directly to the shaft station, but in some places transfer rises are driven to upper levels to reduce haulage distances or avoid hauling over steep grades. The ore from an upper level south-east of and not far from the hoisting shaft is passed through an inclined rise to the main level and scraped from there to the ore pocket. In the north-eastern part of the mine an upper level was developed from an incline driven on a 12% grade from the main level. A drive has been driven beneath the upper level and connected with it by a rise, which is to be used as an ore-pass. As the ore-waste contact on the floor of the stopes is irregular, it is often necessary to leave some ore in the floor or to mine some waste to obtain the desired road grade for ore haulage; this ore is recovered later.

Ore is hoisted from the mine on day shift only, at a maximum rate of 2,000 tons in 6½ hours; the mill is operated 24 hours a day, five days a week.

Mine-run ore is dumped by skip into a 50-ton steel receiving bin, equipped with a 58 in. by 56 in. drop-bar, feeder-type grizzly with 3 in. openings. The oversize is crushed in a Telsmith 25-B gyratory crusher set at 3 in. The crushed ore and grizzly undersize are combined and conveyed to two 5 ft. by 8 ft. single-deck Nordberg screens having ¾ in. by 6 in. screen openings. The screen oversize is crushed in two Allis-Chalmers 460 Hydrocone crushers, each of which is in closed circuit with a Nordberg screen. The screen undersize is weighed by a Merrick weightometer and conveyed to a 2,200-ton steel storage bin. The conveyor is equipped with an automatic tripper for ore distribution. The crushed ore is withdrawn beneath the bin to six conveyors, which discharge on to a central conveyor. The ore is then weighed by another Merrick weightometer and transported on the central conveyor to the rod-mill and jig circuit.

Two optional circuits are available for handling waste rock. In one circuit chutes are placed so that rock dumped from the skip is diverted into a 120-ton steel bin, from which it is withdrawn into trucks for disposal. In the other circuit the waste rock passes through the crushers and screens to the conveyor above a 2,200-ton ore bin, whence it is diverted by a removable chute to a stockpile outside the mill building.

The crushed ore is ground in open circuit at 70% solids in a 9 ft. by 12 ft. Allis-Chalmers rod-mill, loaded with 96,000 lb. of 3 in. diameter steel rods. This operation reduces the ore to a pulp consisting of 39% on 20-mesh, 41% on 100-mesh, and 20% through 100-mesh. The rods, which contain 0·75% carbon, 0·75% manganese, 0·05% phosphorus, and 0·05% sulphur, are consumed at a rate of 0·1779 lb. per ton of ore ground. Aerofloat 31 is added to the rod-mill feed at the rate of 0·066 lb. per ton of feed.

The rod-mill discharge is sampled and flows by gravity to two two-cell Denver duplex mineral jigs with 36 in. by 48 in. cell areas. The first cell of each unit is equipped with a wedge-type, 4 mm. opening, bar-type grid, on which ¼-in. steel shot are bedded to a depth of 1½ in. The second cell of each unit has 3 mm. openings and a bedding of $\frac{3}{16}$-in. shot to a depth of 1½ in.

The jigs are operated at a speed of 212 strokes/min. The length of stroke is $\frac{5}{16}$ in. The only finished product is a hutch lead concentrate, which is stored in an 8½ ft. by 15 ft. conical steel tank. Concentrates are stored in this tank during the second and third shifts and withdrawn during the first shift into an Eimco pan-type filter. The filtrate and the overflow from the storage tank are pumped to the rod-mill grinding circuit. The filtered lead concentrate is conveyed by a 12 in. by 19 ft. 10½ in. screw to a 7 in. by 34 ft. 3⅜ in. bucket elevator.

The elevator discharges into a 150-ton steel storage bin equipped with a 4 ft. 8 in. by 9 ft. screw conveyor. The conveyor loads concentrates into an "auto" tractor and trailer of 38,000 lb. capacity for transportation to rail.

The tailings from the two jigs are ground separately in two 9 ft. by 8 ft. Allis-Chalmers ball-mills in closed circuit with two 78 in. by 35 ft. 4 in. Wemco classifiers. Each ball-mill is charged with 55,000 lb. of 2 in. and 1½ in. steel balls. The ore is ground at a dilution of about 70% solids. The ground feed averages 6% on 48-mesh, 11·5% on 65-mesh, 11·5% on 100-mesh, and 71% through 100-mesh. The balls which contain 0·7% carbon, 0·3% molybdenum, and 0·25% copper, are consumed at the rate of 0·145 lb. per ton of ore ground.

The overflow from the Wemco classifiers is sampled, conditioned with 0·38 lb. of NaCN, 0·065 lb. of $ZnSO_4$, and 0·046 lb. of No. 77 Aerofroth per ton of feed; then pumped to a 6½ ft. by 9 ft., three-way conical steel divider, which splits the feed to three banks of ten 48-in. Agitair lead rougher cells. Air for all flotation cells is supplied by two 12 in. by 30 in. Roots blowers.

The rougher lead concentrate is pumped to a cleaner unit comprising a bank of six 36-in. Agitair cells. The cleaner lead concentrate is pumped to a recleaner unit consisting of one bank of four 36-in. Agitair cells.

The lead recleaner concentrate is sampled and pumped to a 10 ft. by 20 ft. conical steel de-watering tank, from which the overflow goes to a 50-ft. Wemco thickener. The underflow from the steel de-watering tank flows by gravity, and the thickener underflow is pumped to an 8 ft. 10 in. Eimco four-disc filter. The overflow from the Wemco thickener flows to waste. The filtrate from the filter is returned to the thickener. Vacuum for filtration is supplied by two Ingersoll-Rand 22 in. by 9 in. vacuum pumps.

The filtered lead concentrate is conveyed to a 48 in. by 27 ft. 8 in. oil-fired rotary drier, thence to a 120-ton, hopper-bottom, wood storage bin. It is withdrawn from this bin by a conveyor-belt-type feeder and delivered in a 38,000 lb. capacity "auto" tractor and trailer to a 50-ton steel receiving bin to the railroad loading station. The lead concentrate is drawn from this bin, conveyed by a shuttle conveyor, and loaded into railroad cars by a Joy boxcar loader. All lead concentrates are shipped to the Herculaneum (Mo.) smelter.

The rougher flotation tailing is sampled; then, after 0·12 lb. of copper sulphate per ton has been added, the tailing is pumped to a 12 ft. by 10 ft. steel conditioning tank. The conditioned tailing is pumped to a 6½ ft. by 9 ft., steel, two-way conical divider. Here the product is split into two banks of ten 48-in. Agitair cells, which constitute the zinc

rougher circuit. The low zinc content of the ore has necessitated a unique system of recirculation of products in this circuit to control the grade of concentrate.

The rougher concentrate from the last five cells in both banks is returned to the rougher feed ; the tailing, after it has been sampled, flows by gravity to the central entrance of the tailing-disposal line. The rougher concentrate from the first two cells of each bank is pumped to a cleaner unit consisting if one bank of six 36-in. Agitair cells. The concentrate from the last three cells is recirculated to the cleaner feed ; tailings from the last three cells are returned to the rougher feed. The concentrate from the first three cells is pumped to the recleaner circuit—one bank of four 36-in. Agitair cells. The concentrate from the last two cells of the recleaner circuit is returned to the cleaner feed ; tailings from the last two cells join the first cleaner feed. The first two cells of the recleaner unit produce the final zinc concentrate, which is sampled and pumped to a 10 ft. by 20 ft. conical steel storage tank. The overflow from this tank goes by gravity to a 50-ft. Wemco thickener, the overflow from which flows to waste. The underflows from the storage tank and thickener are de-watered in an 8 ft. 10 in. Eimco four-disc filter and the filtrate is returned to the thickener. The filtered concentrate is conveyed to a 60 ton. steel, hopper-bottom bin. Filtering and conveying are completed in about two hours a day. Zinc concentrate is drawn from the storage bin by a conveyor-type feeder into a 38,000 lb. capacity "auto" tractor and trailer and transported to a 25-ton steel receiving bin at the railroad loading platform at Potosi, Mo. From the receiving bin the concentrates are loaded into railroad cars with a shuttle conveyor. All zinc concentrates are shipped to the Josephtown smelter.

Tailing and waste water flow by gravity from the mill 1,500 ft. through a 12-in. pipeline to the upper end of a tailing pond about two miles long.

All dry-crushing units, ore bins, and screens are equipped with adequate dust collectors. Four power-distribution centres—one in the hoistroom and one each for the dry-crushing, wet-grinding, and flotation circuits—are protected from dust by pressurized filtered air. The filtered air is supplied by four American Blower Lineflow fans, each of which produces an air flow of 10,000 c.f.m.

During 1956 the mill operated 255 days, treating 464,392·3 short dry tons of ore having an average analysis of 2·48% lead and 0·35% zinc. The mill produced 14,138·4 short dry tons of lead concentrate containing 79·48% lead and 2,505·6 short dry tons of zinc concentrate containing 57·92% zinc. The mill tailings contained 0·06% lead and 0·04% zinc. Data indicated a metallurgical recovery of 97·57% of the lead and 89·29% of the zinc.

A substantial reduction in lead losses was realized by changing the point of addition of Aerofloat 31 (0·066 lb. per ton) from the flotation cells to the rod-mill feed. Observations disclosed that Aerofloat caused considerable skin flotation of fine lead on the surface of the rod-mill pulp. It was assumed that the same phenomenon would take place in subsequent ball-mill grinding, so the change was made to minimize the possiblitiy of overgrinding and losing fine galena in the flotation tailings.

Trade Paragraphs

Dallow, Lambert and Co., Ltd., of Thurmaston, Leicester, in a recent leaflet indicate many industrial applications of their dust control units with illustrations.

Vickers-Armstrongs (Tractors), Ltd., of Vickers House, Broadway, London, S.W. 1, in a recently issued illustrated folder give particulars of Vickers Onions earth-moving equipment

Head Wrightson Stockton Forge, Ltd., of Stockton-on-Tees, have compiled a leaflet which illustrates and sets out the salient features of their tube-mills and rod-mills.

Victor Products (Wallsend), Ltd., of Wallsend-on-Tyne, devote one of their recent technical bulletins to percussive drilling and give particulars of tungsten-carbide-tipped bits available in the usual sizes in single-chisel or cross types.

Automotive Products Co., Ltd., of Shaw Road, Speke, Liverpool, announce the formation of Lockheed Precision Products, Ltd., as a separate company to undertake the manufacture and selling of their existing hydraulics and hose and coupling divisions.

Suba Hydraulics, Ltd., of 142–4, Carshalton Road, Sutton, Surrey, make available some particulars of their barrel dispenser for delivering liquids without fluctuation or pulsing at a rate of about 15 gal. per minute depending on viscosity and the type of container.

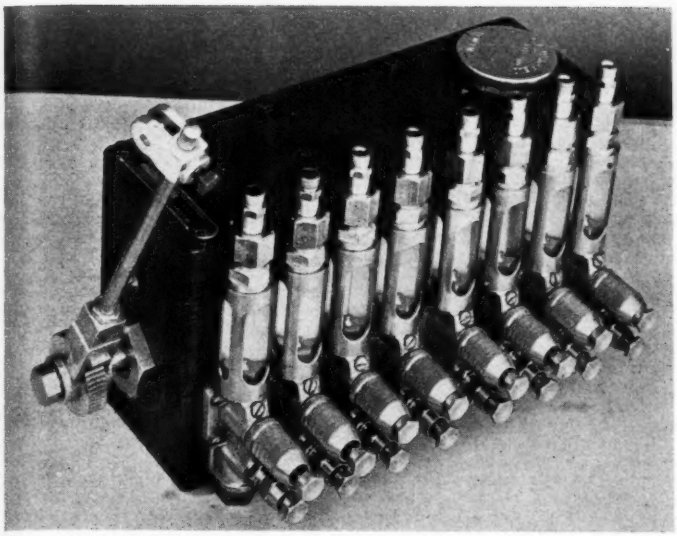
Megator Pumps and Compressors, Ltd., of Berkeley Street, London, W. 1, have published a folder giving particulars in English, French, and German of the Dolphin floating suction strainer which was described and illustrated in the March issue.

Chamberlain Industries, Ltd., of Staffa Road, Leyton, London, E. 10, have produced a 40-page illustrated booklet which deals with press bending of pipes and tubes. This describes the company's hydraulic bender and gives working instructions on its use with data on standard copper and steel tubes.

Chaseside Engineering Co., Ltd., of Hertford, announce that their Loadmaster loading shovels are now available with fully automatic transmission and torque convertor. The installation of this transmission reduces the number of foot controls to two (brake and accelerator) and the gear lever is replaced by a forward and reverse shift lever.

Automatic Coal Cleaning Co., Ltd., of Carlisle, issue a number of leaflets describing and illustrating their products, which include elevators and conveyors, rotary vacuum disc filters, vibrating screens, and the Drewboy dense-medium washing system for coal requiring separation at specific gravities outside the range of a Baum jig.

Nordberg Manufacturing Co., of Milwaukee, Wisconsin (London office : 19, Curzon Street, W. 1), have produced a revised bulletin describing Symons intermediate cone-crushers. These are built in 22-in. and 30-in. sizes with fine or coarse type crushing cavitites for second and third stage reduction crushing. A schematic cross-section of a 30-in. machine shows the principal features with the



Wakefield Mechanical Lubricator.

advantages of controlled feed and even distribution. A table gives average capacities at various settings and feed openings.

Airscrew Company and Jicwood Ltd., of Weybridge, Surrey, are building for the N.C.B. an experimental three-man pedal-driven fan to provide emergency ventilation. The fan is intended to be used in circumstances where there is no electric power available and it might be undesirable or unnecessary to employ a diesel engine. The three men operating the fan will sit side-by-side. The unit will have a 30-in. diameter, eight-bladed wood impeller with an output of 8,000 c.f.m. against a resistance of 0·3 in. when running at 720 r.p.m. The gearing which is of a standard bicycle type has been so designed that a crank speed of approximately 68 r.p.m. will give a fan speed of 720 r.p.m.

A. T. and E. (Wigan) Ltd., of Wigan, have developed a shaft signalling system known as type 57, which is now in operation at Rufford and Warsop collieries, Notts. The chief advantage of the system, the makers state, is that it enables each signal to be automatically sent by simply pressing the appropriate push buttons; this eliminates the tedious task of impulsing by hand and reduces the possibility of wrong signals being transmitted. The audible signals are transmitted automatically and at constant speeds. A miniature indicator panel at each level keeps all persons concerned informed of the signals given from other positions and gives each onsetter visual confirmation of the signal he has sent.

General Electric Co., Ltd., of Magnet House, Kingsway, London, W.C. 2, announce contracts totalling nearly £250,000 for two large winding engines and related equipment which they have received from the National Coal Board. The plants are to serve the Upcast and Downcast shafts at the Duffryn Rhondda colliery, in the South-Western Division. Each equipment will have two 17-ft. diameter by 5 ft. 5 in. wide drums, driven through single-reduction gears by a G.E.C. 3,300-V 2,400-h.p. a.c. motor running at 356 r.p.m. To permit winding from several mine levels one drum will be fitted with a multiple-tooth clutch. The mechanical brakes will be of high-pressure (3,500–5,000 lb./sq. in.) oil-operated type. Another order, valued at about £100,000, has been placed by the North-Eastern Division of the Board for one 400-h.p. and one 1,000-h.p. a.c. winder for Elsecar colliery. The mechanical parts are to be built by Fullerton, Hodgart, and Barclay, Ltd. The 400-h.p. winder will have a parallel two-compartment drum for double-layer coils and is designed to raise men and materials from 1,355 ft., operating from three levels. The 1,000-h.p. machine will have a single drum for single-layer coils and will raise 235 tons of coal an hour from a depth of 1,079 ft. A 3,300-V three-phase 50 c/s supply serves both winders. They will have compensated dynamic braking, although provision is made for fitting the company's speed control system at a later date.

C. C. Wakefield and Co., Ltd., of 46, Grosvenor Street, London, W. 1, announce the production of a new mechanical lubricator, the DP 60, which replaces an earlier model. It is illustrated here. The lubricator feeds oil at a pre-determined rate and quantity to the frictional surfaces of a machine. It is normally actuated by the machine being lubricated and the oil supply, therefore, automatically commences and ceases with the movement of that machine. The DP 60 has two particular advantages in that the usual sight feed glass which withstands pressures up to 600 p.s.i. is replaced by a perspex tube and metal shroud capable of withstanding 2,000 p.s.i. and the oil reservoir is of welded steel construction which, in an eight-feed lubricator, effects a weight saving of as much as 29 lb. over the usual cast-iron type of reservoir. Other features are: Each feed can be regulated from zero to maximum by a regulator screw at the front of the corresponding pump unit. Each feed has a separate flushing plunger operating independently of the pump plunger; full flushing feed can therefore be obtained irrespective of the position of the

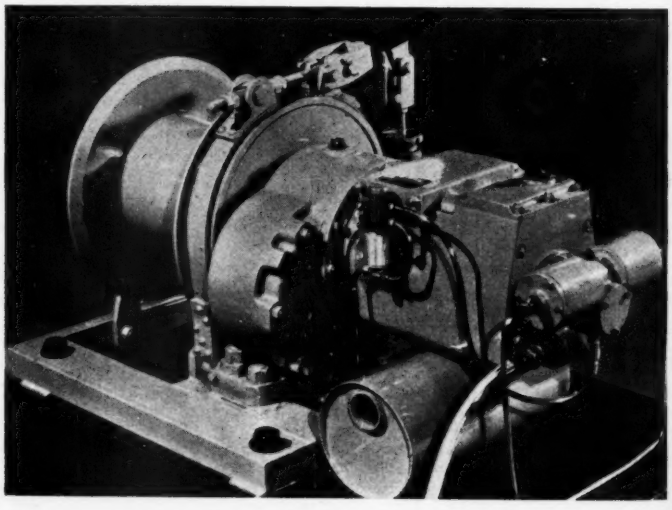
pump plunger. An air vent screw is provided to each feed to disperse air locks should they occur when pumping commences. Each pump unit can be removed and replaced in one assembly. A perspex oil-level gauge is built into the side of the reservoir. The new lubricator which is suitable for both steam and internal combustion engines can be readily applied to the forced feed lubrication of all types of pumps, compressors, crushers, cranes, excavators, and winders.

James Chesterman and Co., Ltd., of Bow Works, Sheffield, 11, are now marketing a radically new style of steel measuring tape, in an attractive chrome case plated throughout for rust resistance and fitted with a new type of press-button pop-up winder handle. The tape itself is white, with jet-black graduations, giving clarity of reading. The only graduations available at present are feet, inches, and eighths, but these incorporate the foot measurement repeated at every inch, which obviates mistakes. By using a special attachment in the case worn or broken tapes can be replaced quickly from a special refill pack and a repair service direct with the manufacturer is offered to the user. Refill tapes are only obtainable from dealers. The tapes are supplied complete in a protective plastic carrier wallet for attaching to the belt and fitted in a bright display box.

Metropolitan-Vickers Electrical Co., Ltd., of Trafford Park, Manchester, were showing at a recent exhibition one of their mine hoist recorders. This is designed to record the number and duration of winds, the winding speed, the decking or changing interval, the starting time, and the time taken for special operations such as shaft or rope inspection and shaft timbering. It is also possible to record the direction of wind and from the record to detect any delay or failure to operate to a desired schedule. The electrically actuated pen records speed more accurately than mechanical governor controlled types and is easily detachable for inspection or filling. The record for the previous hour can be viewed through the perspex window and the complete record can be examined without removal. As only electrical connexions are needed, the recorder can be installed in any desired position without regard for mechanical drives.

Dunlop Rubber Co., Ltd., of St. Georges Road, Coventry, announce that an extra high-pressure flexible hose for use in the mining industry has been developed. Intended for the conveyance of gases and fluids it is expected to be of particular value for rock-drilling and other conditions where flexibility, resistance to vibration, and high working pressures are required. The new pipe, which is reinforced by high-tensile steel braid, has 1¼-in. diameter bore and a working pressure of 4,000 p.s.i. There is an abrasion-resistant neoprene outer cover which is spark-proof and highly resistant to oil, steam, and exposure to sunlight. Operating temperatures for fluids or gases are up to 130° C. and ambient temperatures are from *minus* 30° C. to *plus* 100° C. The metal end fittings are swaged on to the rubber hose, forming an indented pressure seal. The steel insert has an integral annular ring with a wedge-shaped seating formed on the underside which makes contact with the face of the inner lining tube.

Holman Brothers, Ltd., of Camborne, Cornwall, have added three new sizes to their range of air motors, known as Rotomotors, which are of 4 b.h.p., 6 b.h.p., and 7·5 b.h.p. respectively. There are now eleven sizes from 0·75 b.h.p. to 16 b.h.p. Direct drive models or those with single, double, or treble reduction gearboxes are available The company also announce the development of a system of remote control using equipment manufactured by their associated **Maxam Power, Ltd.** This equipment for each Roto-motor unit comprises a hand-operated lever valve situated on the control panel and, in the motor, a rack actuated by duplex pistons situated at each end which engages a pinion on the reversing valve. In the neutral position compressed air is applied to both ends of the duplex pistons and the reversing valve shuts off the air supply to the vanes of the rotor. When the "forward" position is depressed pressure is released from one side of the duplex piston. Being no longer a balanced air pressure the duplex piston and



Holman Rotomotor with Maxam Control.

rack moves across thus turning the reversing valve. This movement allows air to pass to the vanes of the rotor. Choice of " reverse " hand-operated lever valve position moves the duplex piston into reverse which changes the direction of air to the rotor. An emergency stop valve can be placed in circuit in front of the control valve which supplies air to the motor, thereby returning it to the disengaged position irrespective of the position of the control valve. The reversing control valve can be either a single-lever operated valve or two push-button types which automatically assume neutral upon release. A lever control valve can be fitted which also reverts to neutral upon release. Limit switches can be placed between load and motor to limit movement and prevent over-run in either direction. Provision is made on the motor for a valve to control the supply of air to a spring-operated air release brake cylinder when required.

Head Wrightson Stockton Forge, Ltd., of Stockton-on-Tees, a subsidiary of Head Wrightson and Co., Ltd., have recently supplied to I.C.I., Ltd., two dryers, four ball-mills, and two coolers. The dryers are of the parallel-flow single-shell type, 12 ft. in diameter by 90 ft. long and are among the largest machines of this type ever to be built. They have a capacity of approximately 180 tons per hour. The drive is by 300-h.p. squirrel-cage motors through fluid couplings and totally enclosed helical reduction gear units and is connected to the main countershafts which carry the forged steel pinions by flexible couplings. The four ball-mills are 7 ft. diameter by 7 ft. long and each is driven by machine-cut spur gears through reduction gears and flexible couplings from 200-h.p. motors. One of the coolers is 12 ft. diameter by 75 ft. long and the other 11 ft. diameter by 70 ft. long and will be used for handling similar materials to the dryers. They are arranged for counter flow working.

Dowty Mining Equipment Co., Ltd., of Ashchurch, Glos., announce that they are the only British company exhibiting at the Cleveland, Ohio, Coal Show on May 11 to 14 and will show recent developments in automatic hydraulic roof-support systems which offer large economies by eliminating the manhandling of supports and ensure greater safety against roof falls. The company pioneered hydraulic support techniques with the development of the first hydraulic pit prop, of which more than 1½ million have been supplied to coal mines in many parts of the world in the past ten years. Their principal exhibit at Cleveland will be the Dowty " Roofmaster," a self-advancing hydraulic roof-support system which cuts labour requirements on longwall faces and is breaking production records in the U.K. Only two men are required for the continuous operation of 200 support frames and productivity has been increased by as much as 125%. Coal is largely won by shortwall methods in the U.S.A., but the " Roofmaster," by making longwall mining a highly competitive possibility there, could bring major changes in American practice.

Also to be shown at Cleveland is an automatic hydraulic roof-support developed for the shortwall mining methods at present used in the U.S.A. Based on " Roofmaster " principles, it is known as the " Dowty Canopy " and provides mobile support with greater security for face workers over and around a continuous miner or loading machine. Other exhibits will be hand-set hydraulic supports of 20 tons and 50 tons loading and a completely new type of recoverable strata bolt.

Engineering Marine Welding and Nuclear Energy Exhibition

The Engineering Marine Welding and Nuclear Energy Exhibition, which is held every two years and usually takes place in the early autumn, is on this occasion to run from April 16 to 20 at Olympia, London. Some notes follow on exhibits of which advance information has been made available.

W. H. Allen Sons and Co., Ltd., of Bedford, in addition to power generation and pumping plant, are exhibiting an epicyclic gear of which the following particulars are given :—

The gear is a 160-h.p. two-speed unit for transmitting a maximum output torque of 110,000 lb. ft. at a speed of 9 r.p.m. The gearbox is for use on a new type of mine tunnelling machine, driven by a two-speed motor, providing an input speed of 1,500 r.p.m. or 750 r.p.m. Thus, a range of four output speeds is obtained, 24 r.p.m. or 18 r.p.m., 12 r.p.m. or 9 r.p.m. The two-speed gear is followed by a double-reduction gear. The gear unit has an overall ratio of just over 80:1 and this high reduction and large torque are obtained from a unit only 6 ft. long and weighing only 5½ tons. The largest annulus is 30-in. diameter.

Consolidated Pneumatic Tool Co., Ltd., of 232, Dawes Road, Fulham, London, S.W. 6, among the items to be shown on this stand are two which are new to this exhibition. The Tornado medium-weight rock-drill was first described in the MAGAZINE in June last. It is capable of penetrating hard rock at over 3 ft. per minute. The other item is the heavy-duty compressor embodying balanced opposed design for outputs up to 5,000 c.p.m., in which a note appeared in the July issue.

Crofts (Engineers), Ltd., of Bradford, among a wide range of power transmission equipment include a self-driven conveyor pulley known as the " Ritespeed " motorized pulley, it has all the driving mechanism (electric motor and speed reduction gear) housed within the pulley itself. The range covers a number of diameters and gear widths for drives up to 30 h.p.

English Electric Co., Ltd., of Marconi House, Strand, London, W.C. 2, are to show a dual-fuel engine drilling rig for deep well work similar to five recently commissioned by the Iraq Petroleum Co., Ltd., for the Qatar field. In that case natural gas is the fuel. The unit is shown with a hydraulic coupling, the output being 627 b.h.p. on continuous operation or 693 b.h.p. intermittent.

Holman Bros., Ltd., of Camborne, are represented in displays by two of their associated companies, Maxam Power, Ltd., and Goodyear Pumps, Ltd. The first-named company show typical examples of their air cylinders and valves as used in hydraulic control equipment. The Goodyear mining pump is referred to elsewhere in this issue.

International Combustion Products, Ltd., of 19, Woburn Place, London, W.C. 1, from the grinding, screening, and filtering division of the organization is showing an arrangement of a concentrating plant embracing a Ty-Roc screen, a Rovac filter, a Dynocone continuous centrifuge, Vacseal pumps and a Hardinge thickener. This representative display indicates the ability of the company to supply either individual machines for particular requirements or to install complete plants embracing a range of the company's products.

Mond Nickel Co., Ltd., of Thames House, Millbank, London, S.W. 1, will feature the properties of nickel, nickel-containing materials, the platinum metals, and S.G. iron, and will cover corrosion resistance, plating welding, physical properties, strength at high temperatures and toughness at sub-zero temperatures. Among the demonstrations to be included are those of the creep-resistance of the platinum metals, sub-zero properties, integral sheath thermocouples, and apparatus for testing the corrosion-resistance of materials under thermal load.

Murex Welding Processes Ltd., of Waltham Cross, Herts., are showing a wide range of their products for the welding industry, ranging from hand welding electrodes to automatic welding machines, electrodes and fluxes. Considerable attention is devoted to automatic equipment for the welding of mild steels and stainless steels and demonstrations of the Murex " Muramatic " equipment are being given on the stand. Some of the latest models from the range of Murex welding power packs, mobile equipments and welding accessories are also on view.

Saunders Valve Co., Ltd., of Cwmbran, Monmouthshire, are to show their diaphragm valves in a manner to demonstrate their versatility. The range exhibited extends from the ¼-in. laboratory unit to the large stainless-steel valves used in British and Commonwealth atomic reactors. The Saffran pump division will display examples of several designs of centrifugal pumps, including slurry pumps.

Worthington-Simpson, Ltd., of Newark-on-Trent, in a range of pumps and air-compressors draw particular attention to their two-stage oil-cooled rotary compressor, the model to be shown having a displacement of 600 c.f.m. for pressures up to 120 p.s.i. This is the largest in the series but by tandem arrangement capacities up to 1,200 c.f.m. can be secured. Among pumps they feature the introduction of a flameproof motor enclosure in the Monobloc construction which is available for a number of the units in the company's range.

RECENT PATENTS PUBLISHED

☛ A copy of the specification of the patents mentioned in this column can be obtained by sending 3s. 6d. to the Patent Office, Southampton Buildings, Chancery Lane, London, W.C. 2, with a note of the number and year of the patent.

4,020 of 1945 (810,033). F. H. SPADDING, H. A. WILHELM, and W. H. KELLER. Production of uranium.

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3,428–9 of 1955 (810,045–6). IMPERIAL CHEMICAL INDUSTRIES, LTD. Blasting methods and forming blasting charges in substantially vertical bore-holes.

6,758 of 1955 (809,955). SIMON-CARVES, LTD. Separating minerals of different specific gravities.

1,296 of 1957 (810,158). NATIONAL SMELTING CO., LTD. Condensation of zinc from metallic vapours.

3,796 of 1957 (810,892). BATAAFSCHE PETROLEUM MAATSCHAPPIJ N.V. Apparatus for use in the investigation of geological strata.

14,929 of 1957 (809,765). NEW JERSEY ZINC CO. Roasting zinc sulphide ores.

18,029 of 1957 (809,995). ERIE MINING CO. Heat treatment of pellets of finely-divided minerals.

23,083 of 1957 (810,915). E. G. LOESCHE. Grinding mills.

35,385 of 1957 (810,438). BOFORS A.B. Liners for ball- or tube-mills.

38,429 of 1957 (810,019). METALLGESELLSCHAFT A.-G. Sintering process and apparatus.

NEW BOOKS, PAMPHLETS, ETC.

☛ Publications referred to under this heading can be obtained through the Technical Bookshop of *The Mining Magazine*, 482, Salisbury House, London, E.C. 2.

Oil Well Drilling Technology. By A. W. MCCRAY and F. W. COLE. Cloth, octavo, 492 pages, illustrated. Price 80s. Norman, Oklahoma : University of Oklahoma Press.

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Canada : Summary Review of Federal Taxation and Certain Other Federal Legislation Affecting Mining, Oil, and Natural Gas Enterprises in Canada. Compiled by E. C. HODGSON. Paper covers, 23 pages, typescript. Price 25 cents. Ottawa : Department of Mines and Technical Surveys.

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Selected Index to Current Literature

This section of the Mining Digest is intended to provide a systematic classification of a wide range of articles appearing in the contemporary technical Press, grouped under heads likely to appeal to the specialist.

* Article in the present issue of the MAGAZINE. † Article digested in the MAGAZINE.

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